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GREAT LAKES FORESTRY CENTRE
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Results of forest insect and disease surveys in the NORTHEASTERN REGION of Ontario, 1986

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

M. J. Thomson, W. A. Ingram, L. S. MacLeod and S. G. Payne

Miscellaneous Report No. 51

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THE GREAT LAKES FORESTRY CENTRE

The Great Lakes Forestry Centre is one of six regional centres located across Canada and operated by the Canadian Forestry Service. The Service provides federal leadership and a national focus in the forestry sector for the continuing economic, social and environmental benefit of Canadians. The Centre conducts two major programs: research and technical services, and forestry development. Both programs address major problems affecting forest management and the forested environment in Ontario. Because of the transprovincial nature of the forest resource, many elements of the research program are of national significance.

For many years the research program was guided by the Canada-Ontario Joint Forestry Research Committee, made up of senior members of the Centre and the Ontario Ministry of Natural Resources. Responsibilities for coordinating all forestry research in Ontario have now been assumed by the Ontario Forestry Research Committee, which has representatives from forest industry, universities and federal and provincial governments. This Committee also ensures that research results are transmitted to forest managers.

Staff of the forestry development program negotiate and administer federal-provincial cost-sharing agreements with the province of Ontario, conduct economic studies, and assist in implementing job creation programs in the forest sector. This requires close cooperation with the Ontario Ministry of Natural Resources and with other provincial and federal agencies concerned with the forest sector.

The Centre recognizes that forested land must be managed in the best public interest, not only for the wood production essential to our economy but also for the recreational purposes that are so important to our social well-being. These goals must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHEASTERN REGION OF ONTARIO 1986

(FOREST DISTRICTS: WAWA, SAULT STE. MARIE, BLIND RIVER, ESPANOLA, SUDBURY, TEMAGAMI AND NORTH BAY)

M.J. THOMSON, W.A. INGRAM, L.S. MACLEOD AND S.G. PAYNE

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

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SURVEY HIGHLIGHTS

The status of all important forest insects and diseases in the Northeastern Region is presented in the following report. The information contained within was obtained by ground and aerial surveys.

Aerial surveys for the spruce budworm revealed a massive decrease in the area of infestation. In 1985, mapping revealed moderate-to-severe defoliation through approximately 1,522,727 ha of forest; in 1986 14,504 ha were affected. The area infested by the jack pine budworm also decreased dramatically. The area in which moderate-to-severe damage occurred was approximately 56,627 ha--a 93% decrease from that recorded the previous year. In contrast to the abovementioned infestations, increases in the area infested by the large aspen tortrix and the forest tent caterpillar were recorded in 1986. Aerial mapping of trembling aspen stands revealed moderate-to-severe defoliation through approximately 128,060 ha and 264,965 ha of forest, marking increases of 45 and 2.5 times, respectively, over the areas infested in 1985. Populations of the Bruce spanworm occurred for the third consecutive year, causing varying degrees of defoliation in hardwood stands through approximately 29,325 ha, a 4.7% increase over the area affected in 1985. In 1986, as in the previous year, the most severe defoliation was generally found on understory and small regeneration trees. An increase in the distribution of adult gypsy moths was recorded for the second consecutive year when male adults were captured in pheromone traps at 11 points in comparison with five points in 1985. Surveys for larval populations of this insect in areas in which adult moths have been captured, as well as at numerous locations elsewhere in the region, have proved negative thus far.

An increase in Scleroderris canker was recorded for the third consecutive year when new infection centers were found in a jack pine plantation in Wawa District and in red pine plantations at two points in the Blind River District. Increases also occurred in the incidence of damage by the western gall rust in the region.

As in the past several years, a special survey was conducted to determine the impact of damaging agents common to plantations. In 1986, white pine in specific height classes were examined in 10 areas. Overall, damage in the areas surveyed was negligible.

The pinewood nematode, a pest of coniferous tree species, was recorded at seven locations in samples obtained from decadent trees.

The acid rain plots previously established at four locations were resurveyed in 1986.

In this report, the following categories are used to describe the importance of insects or diseases.

Frontispiece. Moderate-to-severe defoliation by forest tent caterpillar, *Malacosoma disstria* Hbn.

Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

*Minor Insects/Diseases**

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees;

(2) those that are capable of causing serious damage but, because of a low incidence or for other reasons, did not cause serious damage in 1985.

Forest districts affected by specific insects or diseases are listed beneath the names of those insects or diseases in the Table of Contents.

The assistance and cooperation extended to the authors by the Ontario Ministry of Natural Resources, wood-using industries and private individuals during the 1986 field season are acknowledged.

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S.G. Payne

* No minor insects or diseases were reported in the Northeastern Region in 1986.

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Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

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INSECTS

Major Insects

Cedar Leafminers, *Argyresthia aureoargentella* Brower, *Coleotechnites thujaella* (Kft.)

Populations of cedar leafminers have been recorded on Manitoulin and Cockburn islands in the Espanola District each year since 1983. In 1986, severe defoliation of eastern white cedar (*Thuja occidentalis* L.) caused conspicuous browning of foliage on affected trees on fringes of stands through approximately 3,000 ha of forest along the southern shores of the aforementioned islands.

Current defoliation generally ranged from 40% to 60%; however, 100% of the current foliage was mined on many trees at Boom Point on Cockburn Island and in the southern portion of the Wikwemikong Indian Reserve on Manitoulin Island.

Cumulative damage caused by leaf mining over the past four years has resulted in considerable branch and whole-tree mortality at scattered locations in the Walkhouse, Dominion and Hungerford areas on Manitoulin Island.

Birch Sawfly, *Arge pectoralis* (Leach)

A general increase in the population level of this sawfly was recorded in the Sudbury, North Bay and Temagami districts in 1986. Moderate-to-severe defoliation of white birch (*Betula papyrifera* Marsh.) occurred in a 0.5-ha stand in McKim Township and through 100 ha of scattered, open-grown regeneration on high, rocky sites adjacent to Highway 17 in Neelon and Dryden townships, Sudbury District. In the North Bay and Temagami districts trace or light defoliation was observed on lakeshores and along roadsides at several locations.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)

Populations and distribution of this insect increased for the second consecutive year in the Northeastern Region. Medium-to-heavy infestations were observed in trembling aspen (*Populus tremuloides* Michx.) stands through approximately 128,060 ha of forest in parts of the Sault Ste. Marie, Blind River, Espanola and Sudbury districts (Fig. 1), marking an increase of 45 times over the area infested in 1985.

Aerial surveys in Sault Ste. Marie and Blind River districts revealed scattered pockets of moderate-to-severe defoliation through approximately 1,400 ha of forest in the southern part of the former district and 100 ha in the latter. Ground observations in the infested areas revealed that two other insects fed in conjunction with the large aspen tortrix: the aspen twoleaf tier, *Enargia decolor* (Wlk.) and the

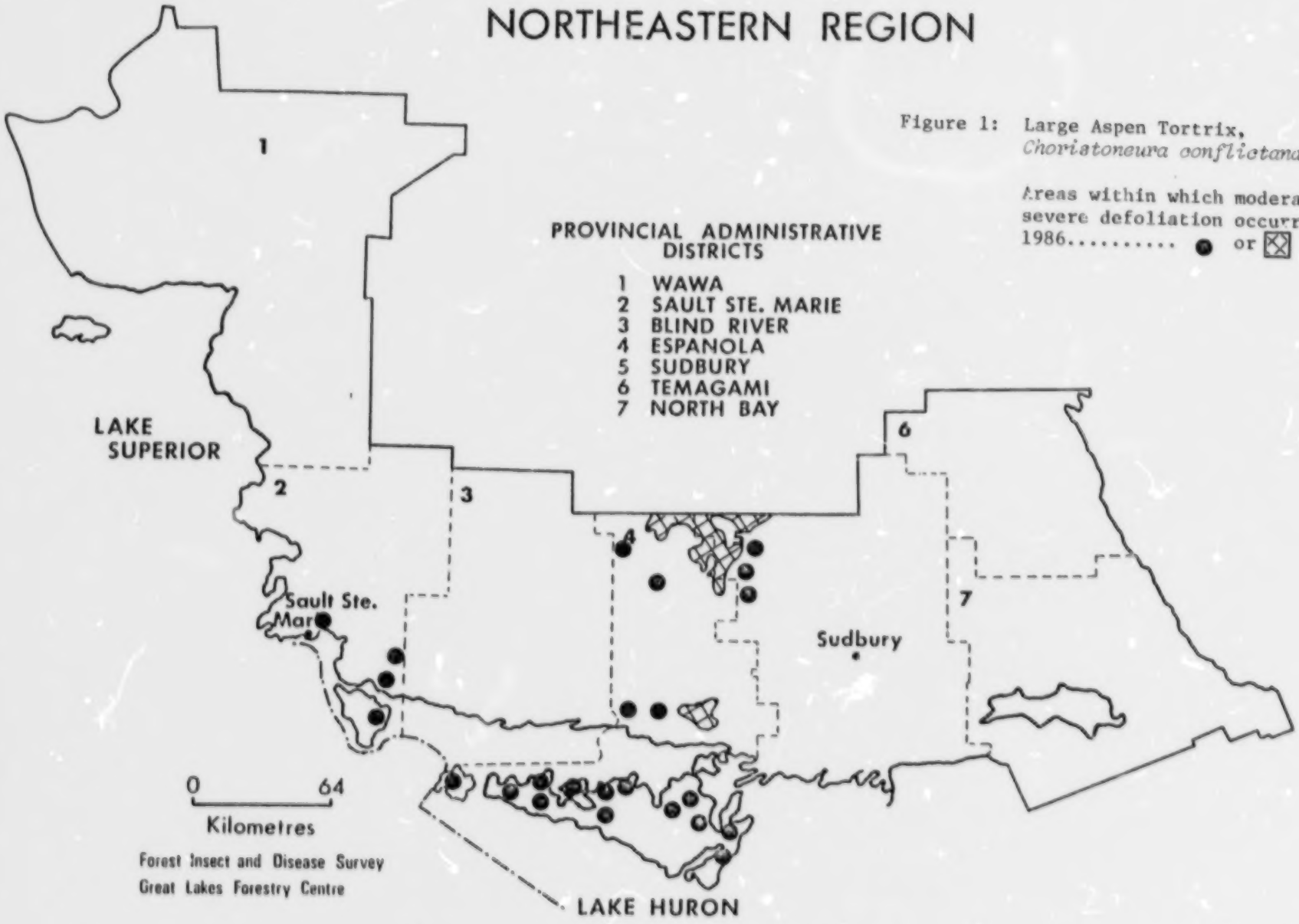

Figure 1: Large Aspen Tortrix, *Choristoneura conflictana* Wlk.

Areas within which moderate-to-severe defoliation occurred in 1986..... ● or ⊠

Bruce spanworm, *Operophtera bruceata* (Hlst.). Therefore, it was not possible to determine accurately the percentage of defoliation caused solely by the large aspen tortrix.

In the Espanola District, a marked increase in the area of infestation was evident when aerial surveys revealed damage caused by the insect feeding through approximately 94,800 ha of forest in comparison with 1,500 ha in 1985. The major increase in the area of infestation occurred in the northern half of the district; however, an increase in area was also recorded in the southern part, including Manitoulin Island, where pockets of infestation had been reported the previous year. Defoliation ranged from approximately 40% to 80% through the area affected.

New infestations were also recorded in the Sudbury District. Aerial surveys revealed damage to aspens through approximately 31,700 ha of forest in the northwestern part of the district. Defoliation in the area was approximately equal to that recorded in the northern half of the Espanola District.

Records of previous infestations occurring at widely scattered points indicate that high populations usually persist for only two or three years.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Results of damage surveys, population sampling and egg-mass counts of the spruce budworm will be published with those of other regions at a later date in a report devoted specifically to this insect. The report will provide a complete description and analysis of developments in the spruce budworm situation in Ontario in 1986 infestation forecasts for the province for 1987.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

In 1986, infestations of the jack pine budworm decreased markedly after increasing to an epidemic level in 1984 and 1985 in the Northeastern Region (Fig. 2). Infestations that occurred in the Sault Ste. Marie and Temagami districts in 1985 collapsed, leaving populations confined to the Blind River, Espanola, Sudbury and North Bay districts in 1986 (Fig. 3). Aerial mapping in these districts revealed pockets of moderate-to-severe defoliation of jack pine (*Pinus banksiana* Lamb.) extending through approximately 24,740 ha, 1,212 ha, 30,130 ha and 545 ha, respectively, of host stands, marking a decrease from the previous year of more than 90% in area affected.

Defoliation by the insect was extremely variable, as it was in 1985. In some of the affected stands, there was considerable foliage discoloration in July, as host trees were uniformly defoliated, whereas

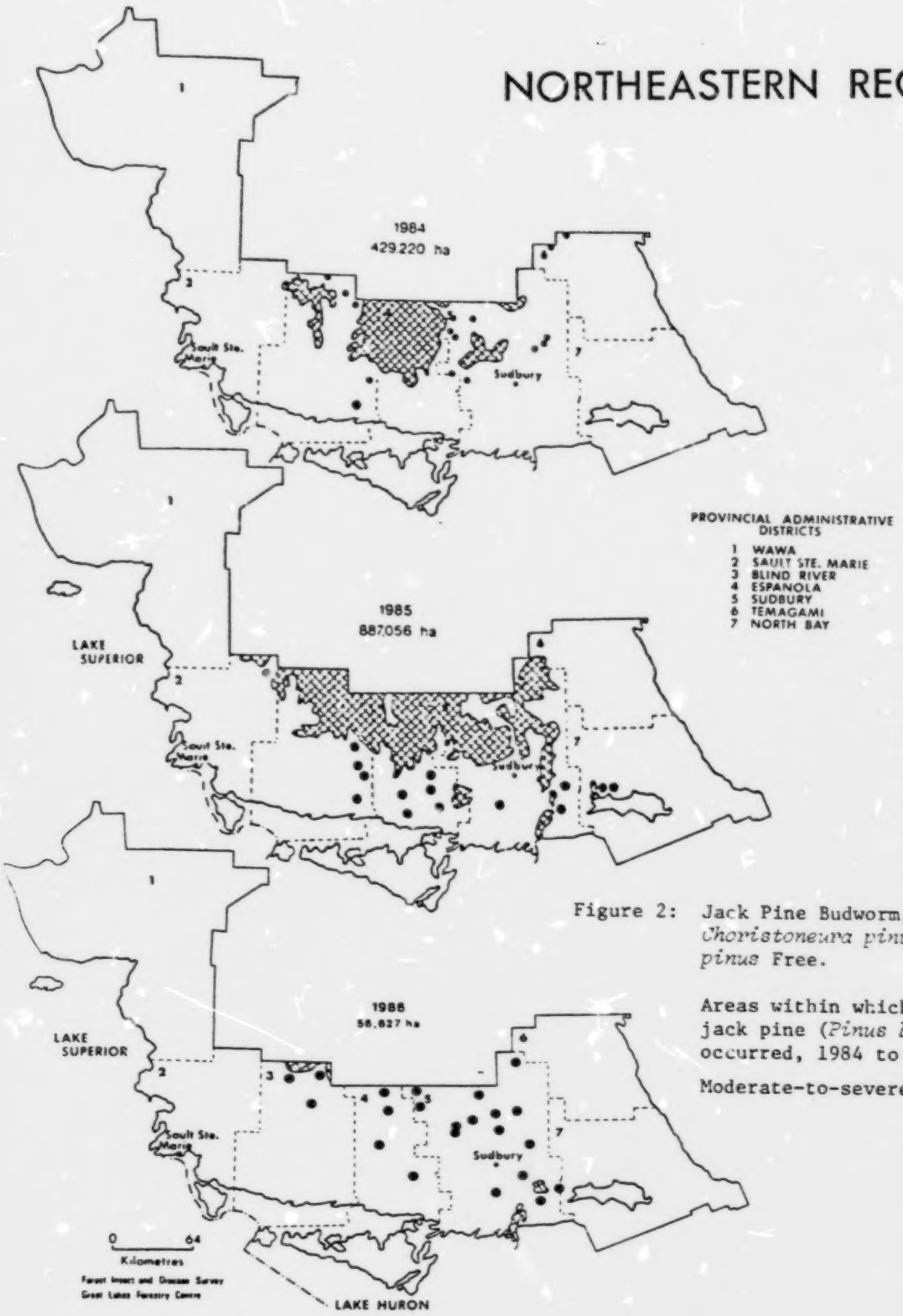

Figure 2: Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Areas within which defoliation of jack pine (*Pinus banksiana* Lamb.) occurred, 1984 to 1986

Moderate-to-severe.... ● or ⊠

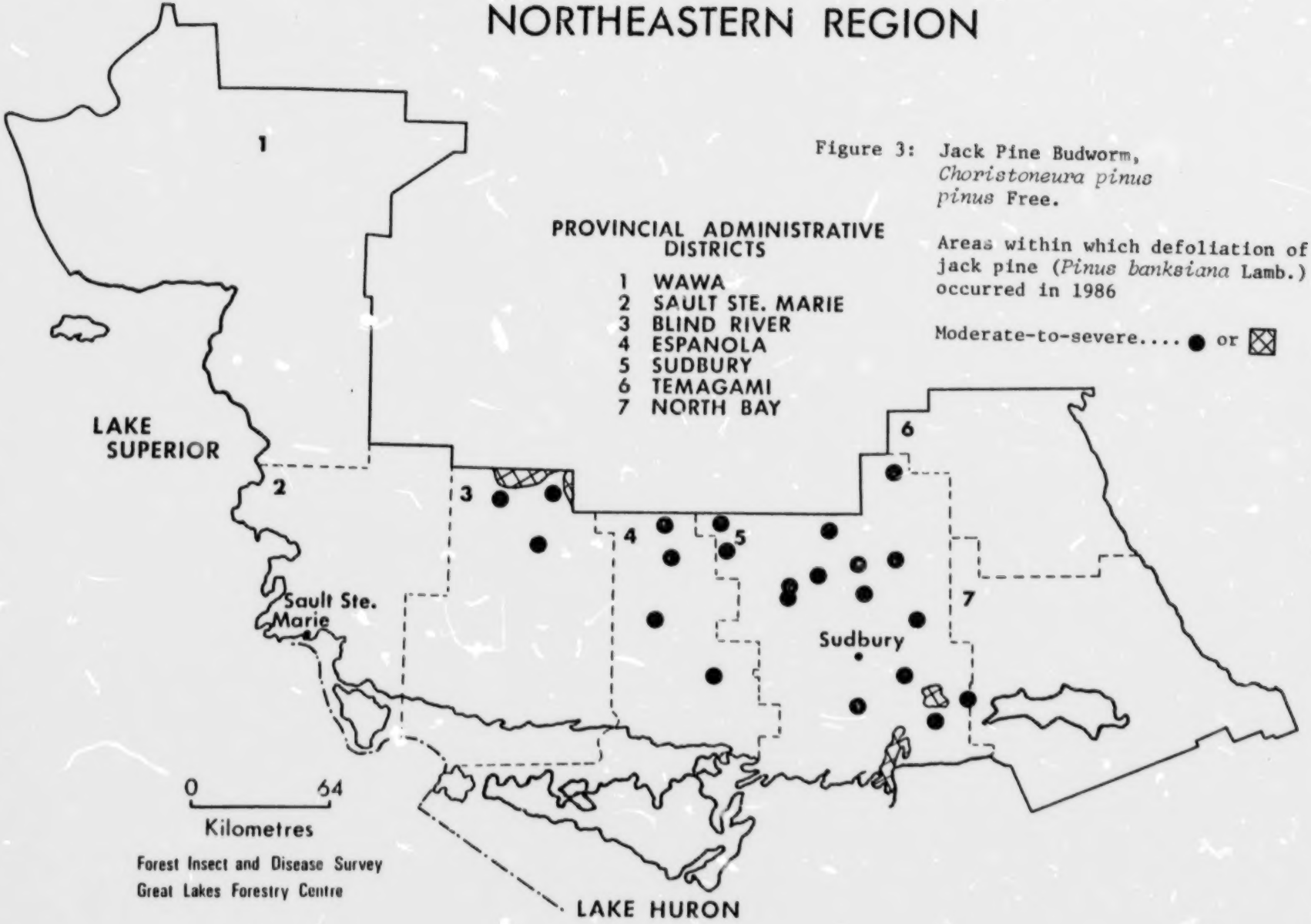

Figure 3: Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Areas within which defoliation of jack pine (*Pinus banksiana* Lamb.) occurred in 1986

Moderate-to-severe.... ● or ⊠

in other areas only occasional trees or small pockets of them were damaged either within stands or on fringes of stands.

In 1985, semipermanent sample plots were established at 14 points in the region in areas that had experienced moderate-to-severe defoliation by the budworm. A total of 100 trees were marked in each plot, and tree heights and diameters were measured. In 1986, each plot was monitored and whole-tree or top mortality was recorded. The records show that tree mortality ranged from 2% to 15% and top mortality ranged from 1% to 32% in 12 and 10 of the plots, respectively (Table 1).

Table 1. Summary of whole-tree and top mortality associated with damage caused by jack pine budworm in the Northeastern Region in 1986 (counts based on the examination of 100 jack pine trees at each location).

Location (Twp)	Avg DBH (cm)	Whole-tree mortality (%)	Top mortality (%)
Blind River District			
Gaunt	10	12	0
Lane	13	4	0
Sagard	10	7	10
Winkler	15	7	1
Espanola District			
Gervais	22	11	6
Monestime, Area 1	22	15	11
Monestime, Area 2	13	6	32
Olinyk	24	7	5
Sudbury District			
Cartier	19	2	0
Cascaden	15	0	2
Cox	17	7	16
Hart	17	0	0
Levack	21	2	3
Ulster	17	4	2

Egg surveys were made in 81 locations in 1986, in infested and adjacent areas throughout the region, to provide information on overwintering larval populations and to assess the potential for damage in 1987 (Table 2). On the basis of these counts, decreases in populations can be expected for the second consecutive year as eggs were found on only 35% of the samples and only in small numbers, all from the Blind River, Espanola and Sudbury districts. Although light damage may occur in the above districts, none is expected elsewhere in the region.

Control operations against the jack pine budworm were carried out for the second consecutive year in the Northeastern Region. Approximately 155,330 ha of forests in the Blind River, Espanola and Sudbury districts were treated with the biological insecticide Dipel 132 or Thuricide 48LV, which are different formulations of *Bacillus thuringiensis (B.t.)*. Preliminary results indicate that good control was obtained.

Whole-tree and top mortality figures for 1986 are given in Table 1. Defoliation, egg-mass counts and infestation forecasts are given in Table 2. A special report devoted specifically to this pest will be published at a later date and will provide information on budworm population densities, reductions, more details of the spray program, assessment and forecasts for the province.

Table 2. Northeastern Region--jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine.

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[a]
Blind River District (20 locations)				
Bouck Twp	0	0	N	N
Gaunt Twp - Impact Plot	7	3	M	L
- Block 14	4	5	M	L
Kirkwood Twp	0	0	N	N
Lane Twp - Check Plot 2	17	1	L	L
- Check Plot 5	16	4	M	L
Leluk Twp	28	1	L	L
Martel Twp - Impact Plot	31	0	N	N
Nicholas Twp	0	0	N	N
Nuttall Twp	3	1	L	L
Rose Twp	0	0	N	N
Ruston Twp	40	8	H	L
Sagard Twp - Impact Plot 1	0	1	L	L
- Impact Plot 118	1	0	N	N

(cont'd)

Table 2. Northeastern Region--jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine.

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[a]
Blind River District (cont'd) (20 locations)				
Vance Twp - East	0	1	L	L
- West	0	0	N	N
Villeneuve Twp	0	0	N	N
Wardle Twp - Check Plot	6	1	L	L
Winkler Twp	17	0	N	N
Yaremko Twp	5	0	N	N
Espanola District (24 locations)				
Acheson Twp - Stand 172	0	0	N	N
Avis Twp	1	0	N	N
Comox Twp - Stand 126	0	3	M	L
Craig Twp - Stand 30	1	0	N	N
Del Villano Twp	22	3	M	L
Dennie Twp - Stand 120	9	0	N	N
Dunlop Twp - Stand 136	2	1	L	L
Durban Twp - Block 7	0	0	N	N
Fontaine Twp - Stand 136	13	1	L	L
Foucault Twp	0	0	N	N
Gervais Twp - Check Plot	0	0	N	N
Gilbert Twp - Stand 217	1	0	N	N
Hotte Twp - Spray Block	0	1	L	L
Mandamin Twp - Block 36	14	1	L	L
Merritt Twp - Espanola	15	0	N	N
Merritt Twp - Espanola	6	0	N	N
Monestime Twp - Impact Plot	0	0	N	N
Moses Twp - Impact Plot	0	0	N	N
Nairn Twp	0	1	L	L
Olinyk Twp - Block 23	0	0	N	N
Prescott Twp - Block 17	0	0	N	N
Teasdale Twp - Impact Plot	0	0	N	N
Tennyson Twp - Stand 77	0	0	N	N
Weeks Twp - Impact Plot	0	1	L	L
North Bay District (5 locations)				
Hugel Twp	1	0	N	N
Janes Twp	0	0	N	N

(cont'd)

Table 2. Northeastern Region--jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine. cont'd)

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[a]
North Bay District (cont'd) (5 locations)				
McNish Twp	1	0	N	N
McWilliams Twp	0	0	N	N
Springer Twp	1	0	N	N
Sault Ste. Marie District (1 location)				
Parke Twp	1	0	N	N
Sudbury District (27 locations)				
Acadia Twp	0	0	N	N
Allen Twp	57	1	L	L
Antrim Twp - Block 129	0	0	N	N
Appleby Twp	56	4	M	L
Aylmer Twp	0	0	N	N
Cartier Twp - Impact Plot 26	0	2	L	L
- Impact Plot 27	0	0	N	N
Casimir Twp	48	5	M	L
Cascaden Twp - Windy L. Prov. Pk	1	0	N	N
- Check Plot	1	1	L	L
Cosby Twp	9	3	M	L
Cox Twp	0	0	N	N
Delamere Twp	1	0	N	N
Ermatinger Twp - Impact Plot	0	0	N	N
Haddo Twp	0	0	N	N
Hart Twp - Block 112	1	0	N	N
- Check Plot	1	0	N	N
Howey Twp - Block 56	1	1	L	L
Hutton Twp - Block 122	2	3	M	L
Jennings Twp	90	8	H	L
Louise Twp	2	1	L	L
Lumsden Twp - Impact Plot	0	1	L	L
Moncreiff Twp - Block 112	2	0	N	N
Munster Twp - Seed Orchard	2	0	N	N

(cont'd)

Table 2. Northeastern Region--jack pine budworm: Summary of defoliation estimates and egg-mass counts in 1986 and infestation forecasts for 1987 on jack pine. (concl.)

Location	Estimated defoliation 1986 (%)	Total no. of egg masses on six 61-cm branch tips	Standard infestation forecasts for 1987[a]	Modified infestation forecasts for 1987[a]
Sudbury District (cont'd) (27 locations)				
Rhodes Twp - Stand 137	1	0	N	N
Scadding Twp	2	0	N	N
Ulster Twp - Impact Plot	0	0	N	N
Temagami District (2 locations)				
Gillies Limit Twp - Stand 221	0	0	N	N
Strathy Twp - Stand 203	0	0	N	N
Wawa District (3 locations)				
Cecile Twp	1	0	N	N
Magone Twp	0	0	N	N
Mikano Twp	0	0	N	N

[a] N = nil, L = light, M = moderate, H = heavy

[b] Modified infestation forecasts: During the last major jack pine outbreak in Ontario, the following standard jack pine defoliation forecast was developed:

Total egg masses on six 60-cm tips (Year X)	Defoliation forecast (Year X + 1)	Defoliation (Year X + 1) (%)
0	0	0
1-2	light (L)	1-25
3-5	moderate (M)	26-75
6+	severe (S)	76+

This relationship was found to be reliable during the first year or two of the current jack pine budworm outbreak, but in older infestations (3-4 years) it generally overestimated the defoliation potential. The "modified infestation forecast" presented in these tables is based on analysis of egg-mass counts and subsequent defoliation in 1984, 1985 and 1986 from northwestern and northeastern Ontario. The reasons for modifying the forecast are related to an increase in parasitism rates and a reduction in the production of male flowers.

Jack Pine Tip Beetle, *Conopthorus banksianae* McP.

Surveys for this pest of jack pine and Scots pine (*Pinus sylvestris* L.) in jack pine plantations or regenerated areas revealed that an average of 13% of the trees examined in the Sault Ste. Marie, Blind River and Temagami districts had been attacked (Table 3). Attack by the pest kills the current growth; therefore, when leading shoots are attacked, the height and form of the tree are affected.

Table 3. Summary of damage by the jack pine tip beetle in the Northeastern Region in 1986 (counts based on the examination of 150 randomly selected juvenile jack pine trees at each location).

Location	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Trees affected (%)	Leader attack (%)
Sault Ste. Marie District					
Hurlburt	50	5,000	2.0	2.6	0.6
Blind River District					
Lane	50	3,000	1.0	20.6	7.3
Lane	25	3,000	2.0	15.3	0.6
Villeneuve	50	3,000	2.0	22.6	2.0
Temagami District					
Milne	50	5,000	1.3	15.3	2.1
Barr	50	4,000	2.2	2.6	1.3

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)

Populations of this insect, a serious pest of red oak (*Quercus rubra* L.), declined for the second consecutive year in the Sault Ste. Marie and Blind River districts. Surveys revealed only a trace of defoliation at two semipermanent sample points in each of the above districts.

Experimental pheromone trapping at four locations was continued in 1986 as part of a continuing survey to evaluate the potential of pheromones as a tool in forecasting infestations. At present, results are inconclusive; therefore, further studies will be carried out.

Egg surveys at these sample points indicate that populations will collapse in the Sault Ste. Marie District and that trace-to-light defoliation will likely recur in the Blind River District (Table 4).

Table 4. Summary of oak leaf shredder egg counts on red oak trees in 1986 and infestation forecasts for 1987 in the Northeastern Region (counts based on the examination of eight 35-cm branch tips selected randomly from four trees at each location).

Location	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Avg no. of eggs per branch tip	Infestation forecasts for 1987
Sault Ste. Marie District					
Hurlburt	50	500	25	0.0	nil
Tarentorus	25	500	20	0.0	nil
Blind River District					
Thessalon	200	300	25	3.0	light
Long	25	200	15	0.9	light

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

Populations of this insect pest of pine plantations and regeneration stands have remained generally at a low level in the Northeastern Region over the past several years. Damage surveys revealed that populations remained low in 1986, when only small numbers were recorded in six areas evaluated at widely separated points (Table 5). There was no evidence of damage in numerous plantations surveyed elsewhere in the region. The insect attacks both lateral shoots and leaders. Lateral shoot attack is considered of little consequence; however, when leaders are damaged the height of the tree is reduced and tree form is affected.

Birch Leafminer, *Fenusa pusilla* (Lep.)

High populations of this leafminer were recorded at scattered locations in the Northeastern Region in 1986. Moderate-to-severe foliage mining was observed in a 50-ha stand of white birch regeneration in Leguerrier Township in the Wawa District and through 200 ha of scattered trees in the Latchford-Cobalt area in the Temagami District. Similar defoliation levels occurred on roadside and ornamental trees in Curtis Township in the Sault Ste. Marie District and in the cities of Sudbury and North Bay.

Aerial observation revealed small pockets of heavy damage at widely scattered locations in remote areas in the Sudbury, North Bay and Temagami districts as well. Elsewhere, light defoliation was observed along roadsides at widely separated points throughout the region.

Table 5. Summary of damage by the eastern pine shoot borer in the Northeastern Region in 1986 (counts based on the examination of 150 pine trees at each location).

Location (Twp)	Host(s)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Leaders attacked (%)
					1986
Sault Ste. Marie District					
Hodgins	JP	10	3,000	2.0	1.0
Blind River District					
Timbrell	JP	10	3,000	2.0	1.0
Espanola District					
Tennyson	ScP	10	3,500	2.4	1.0
North Bay District					
Gurd	rP	40	4,000	1.0	5.0
Temagami District					
Milne	JP	50	5,000	1.3	4.0
Barr	JP	50	4,000	2.2	3.5

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Infestations of this hardwood defoliator, primarily of aspen, increased for the third consecutive year in the Northeastern Region. Aerial mapping revealed large areas or pockets of medium-to-heavy infestation (see Frontispiece) through 264,965 ha of forest in the Wawa, Blind River, Espanola, North Bay and Temagami districts, making an increase of 2.5 times over the area infested in 1985 (Fig. 4).

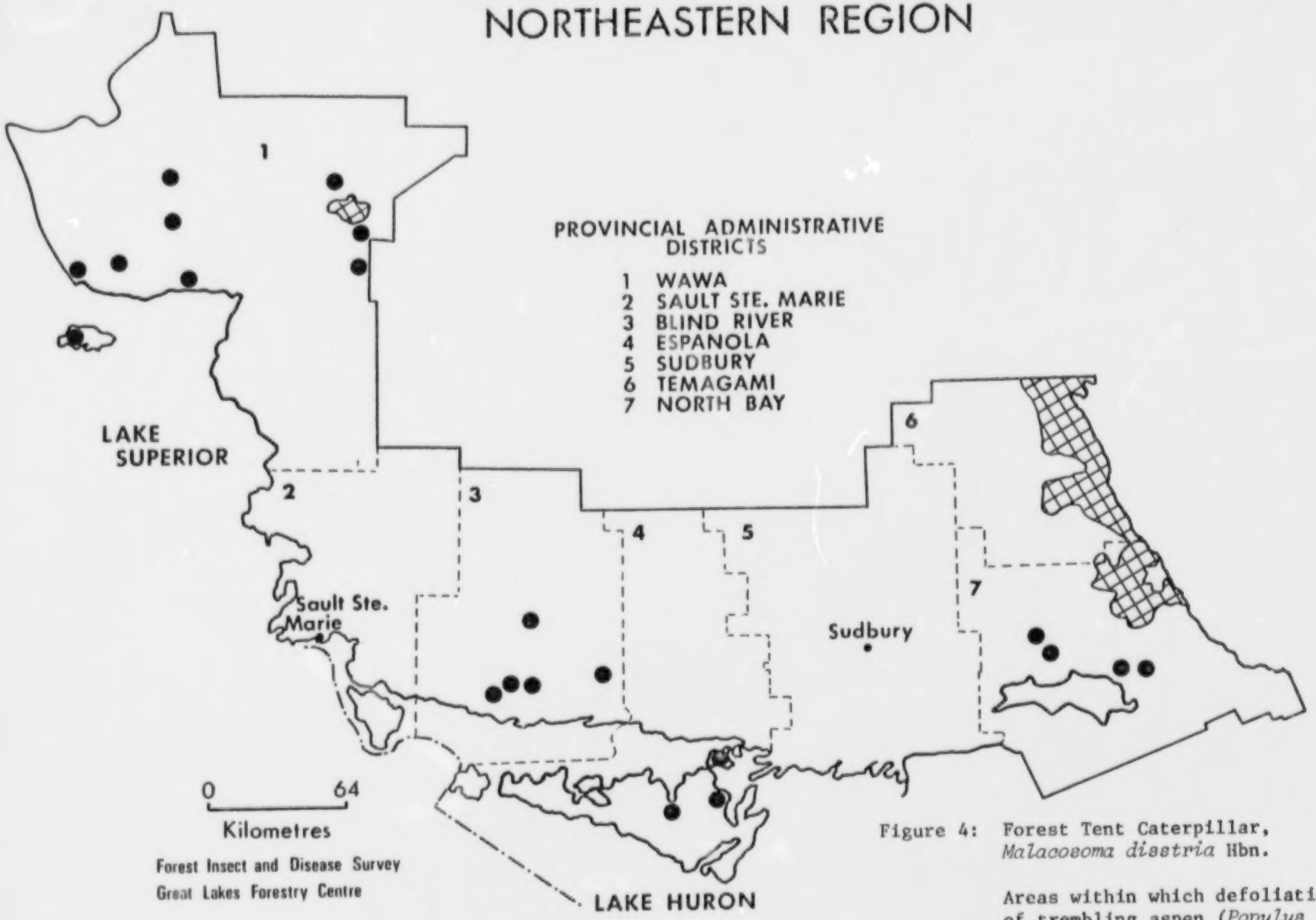

Figure 4: Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Areas within which defoliation of trembling aspen (*Populus tremuloides* Michx.) occurred in 1986

Moderate-to-severe... ● or ⊠

The largest area of infestation occurred in the eastern half of the Temagami District, where medium-to-heavy damage was mapped through 163,540 ha of forest, extending southward from the northern boundary of the district to Burnaby and Fett townships on the southern boundary.

In the North Bay District, a large new area of medium-to-heavy infestation was recorded through 86,920 ha of forest in the northeast quarter, extending southward from the northern district boundary to Mulock Township and westward from the eastern district boundary to Gooderham and Hammell townships. Pockets of new infestation occurred south of the above infestation in Eddy and Butler townships, at scattered points near the east end of Lake Nipissing and in a small area in parts of four townships north of the town of Sturgeon Falls.

Heavy new infestations were mapped through approximately 5,230 ha of forest at two locations on Manitoulin Island and in the northwestern quarter of Great La Cloche Island in the southern part of the Espanola District.

In the Blind River District, an increase in area of medium-to-heavy infestation was recorded and various degrees of damage were mapped through 4,940 ha of forest in comparison with 300 ha in 1985. The area of infestation previously reported in the Depot Lake area south of Elliot Lake increased by more than four times, and susceptible stands were damaged through 1,260 ha of forests. Elsewhere in the district, new pockets of heavy infestation were observed through 3,680 ha of forest at scattered locations from the Iron Bridge area eastward to Lauzon Lake and northward to the Endikai Lake area in Albanel Township.

A marked increase in the area infested by this insect was recorded in the Wawa District as well when aerial mapping revealed pockets of medium-to-heavy infestation at 22 points, encompassing a total of 14,335 ha of forest. These pockets of damage were situated near Missinabi Lake in the eastern part of the district and in the area west of Highway 17, including Michipicoten Island. The infestation was generally confined to the southern part of the district; however, small areas of damage were observed east of the White Lake Provincial Park in the north and in Memaskwosh and Keating townships directly south of White River.

Elsewhere in the region, single wandering larva and scattered colonies were observed at numerous locations. The most severe foliar damage was evident in the Temagami-North Bay district infestation, where defoliation ranged from 75% to as much as 100%. Defoliation in affected areas in the other districts mentioned was generally lighter, ranging from approximately 50% to 90%.

Dissection of caterpillar cocoons at six locations revealed that the incidence of successful adult emergence ranged from 29% to 85% and averaged 52.6%. A pupal parasite, *Sarcophaga aldrichi* Park., was responsible for 94.7% of the unsuccessful emergence, followed by a low

incidence of an unidentified disease recorded at two points (Table 6). Past records show that before a caterpillar infestation declines to an endemic level, successful adult emergence must also decline by at least 98%. The abovementioned fly plays a major role in causing a decline.

Table 6. Summary of forest tent caterpillar cocoon dissections in three districts in the Northeastern Region in 1986 (counts based on the dissection of 100 cocoon at each location).

Location (Twp)	Parasitized (%)	Diseased (%)	Adult emergence (%)
Blind River District			
Albanel	56	0	44
Thompson	71	0	29
Proctor	71	0	29
Espanola District			
Sheguiandah	26	13	61
North Bay District			
Springer	15	0	85
Poitras	30	2	68

Egg-band surveys were carried out either within or on the perimeter of infested areas at 18 locations in September 1986 (Fig. 5). Eggband counts in the survey ranged from 1 to a high of 93 and averaged 25.5 over all (Table 7).

On the basis of a high incidence of adult emergence and numbers of new egg bands present in 1986, heavy caterpillar infestations are likely to recur and spread through large areas of forest in 1987.

Early Birch Leaf Edgeminer, *Messa nana* (Klug)

This leafminer is of European origin and was first recorded in the region in 1985. Low numbers were found on open-grown white birch on rocky sites in conjunction with the birch leafminer and the ambermarked birch leafminer, *Profenusa thomsoni* (Konow), in and around the city of Sudbury in the Sudbury District.

Light defoliation was again recorded at two points adjacent to the area in which damage was previously recorded in the city of Sudbury. One additional area of light defoliation was recorded in Hugel

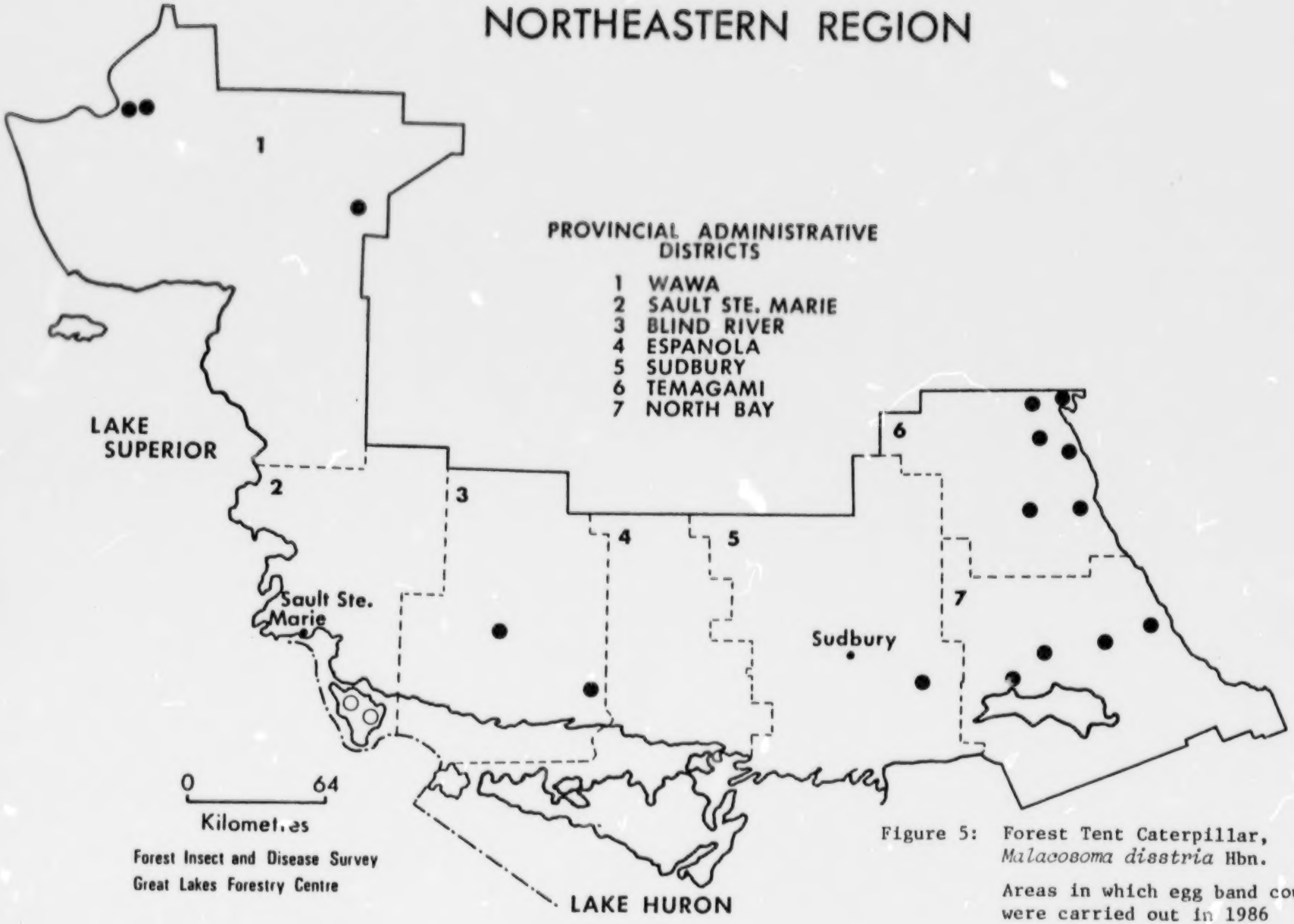

Figure 5: Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Areas in which egg band counts were carried out in 1986

Light forecast..... ○
Heavy forecast..... ●

Township, North Bay District, some 50 km to the east of the Sudbury infestation. This is the first record of the insect in the North Bay District.

Table 7. Summary of of forest tent caterpillar egg-band counts in 1985 and 1986 and infestation forecasts for 1987 in the Northeastern Region (counts based on the examination of one or three trees at each location).

Location	Host(s)	Avg DBH of sample trees/cm	No. of trees examined	Avg no. of egg bands per tree		Infestation forecasts for 1987
				1985	1986	
Wawa District						
Laberge	tA	13	3	-	31	heavy
McCron	tA	12	3	-	32	heavy
West	tA	14	3	-	2	light
Sault Ste. Marie District						
Hilton	sM	15	3	-	1	light
St. Joseph	tA	13	3	-	2	light
Blind River District						
Albanel	tA	14	1	-	23	heavy
Proctor	tA	12	1	12	27	heavy
Sudbury District						
Appleby	tA	10	3	-	12	heavy
North Bay District						
Poitras	tA	13	1	-	45	heavy
Springer	tA	12	1	-	93	heavy
Stewart	tA	13	1	-	17	heavy
Grant	tA	13	1	-	26	heavy
Temagami District						
Strathcona	tA	5	1	-	20	heavy
Hebert	tA	5	1	-	21	heavy
Coleman	tA	10	1	-	51	heavy
Lorrain	tA	8	1	31	31	heavy
Hudson	tA	8	3	57	11	heavy
Harris	tA	8	3	-	14	heavy

Bruce Spanworm, *Operophtera bruceata* (Hlst.)

High populations of this hardwood defoliator occurred for the third consecutive year in the Northeastern Region in 1986. Aerial surveys revealed large areas of defoliation caused by the insect feeding in sugar maple (*Acer saccharum* Marsh.), red oak and trembling aspen stands in the Sault Ste. Marie and Espanola districts (Fig. 6).

In the Sault Ste. Marie District, damage extended through most of the southern third of the district from St. Joseph Island to the Haviland Bay area, affecting approximately 23,400 ha of forest. Ground surveys revealed various degrees of defoliation through the area, sugar maple generally sustaining the most severe damage. Understory sugar maple regeneration was the most heavily damaged; however, overstory maples in many stands suffered moderate-to-severe defoliation, ranging from 40% to as much as 75%. Stands of red oak and trembling aspen were generally less seriously affected.

In the Espanola District, population levels and areas of infestation increased and caused moderate-to-severe defoliation ranging from 30% to 80% on both overstory and understory hosts through approximately 5,900 ha of forest on Manitoulin and Cockburn islands. Although sugar maple was the primary host affected, red oak and trembling aspen were also damaged at numerous points. In many of the stands examined in the above districts a population of the large aspen tortrix, *Choristoneura conflictana* (Wlk.), was intermingled with the spanworm population; therefore, it was impossible to assess the extent of defoliation caused by either insect alone.

A ground beetle predator of the Bruce spanworm, *Calosoma prigidum* Kby., was commonly observed for the third consecutive year at several points on St. Joseph Island in the Sault Ste. Marie District.

White Pine Weevil, *Pissodes strobi* (Peck)

After declining for two consecutive years, populations of this perennial pest of pines increased in 1986 in the Northeastern Region (Fig. 7). Damage evaluations in pine plantations and regenerated areas at 25 locations revealed that the incidence of attack averaged 4.5% in comparison with 3.1% at 13 points evaluated in 1985. Damaged leaders ranged from 1% in Recollet and Gurd townships in the Wawa and North Bay districts to 14% in a 10-ha Scots pine seed orchard established by the Ontario Ministry of Natural Resources in Tennyson Township, Espanola District (Table 8).

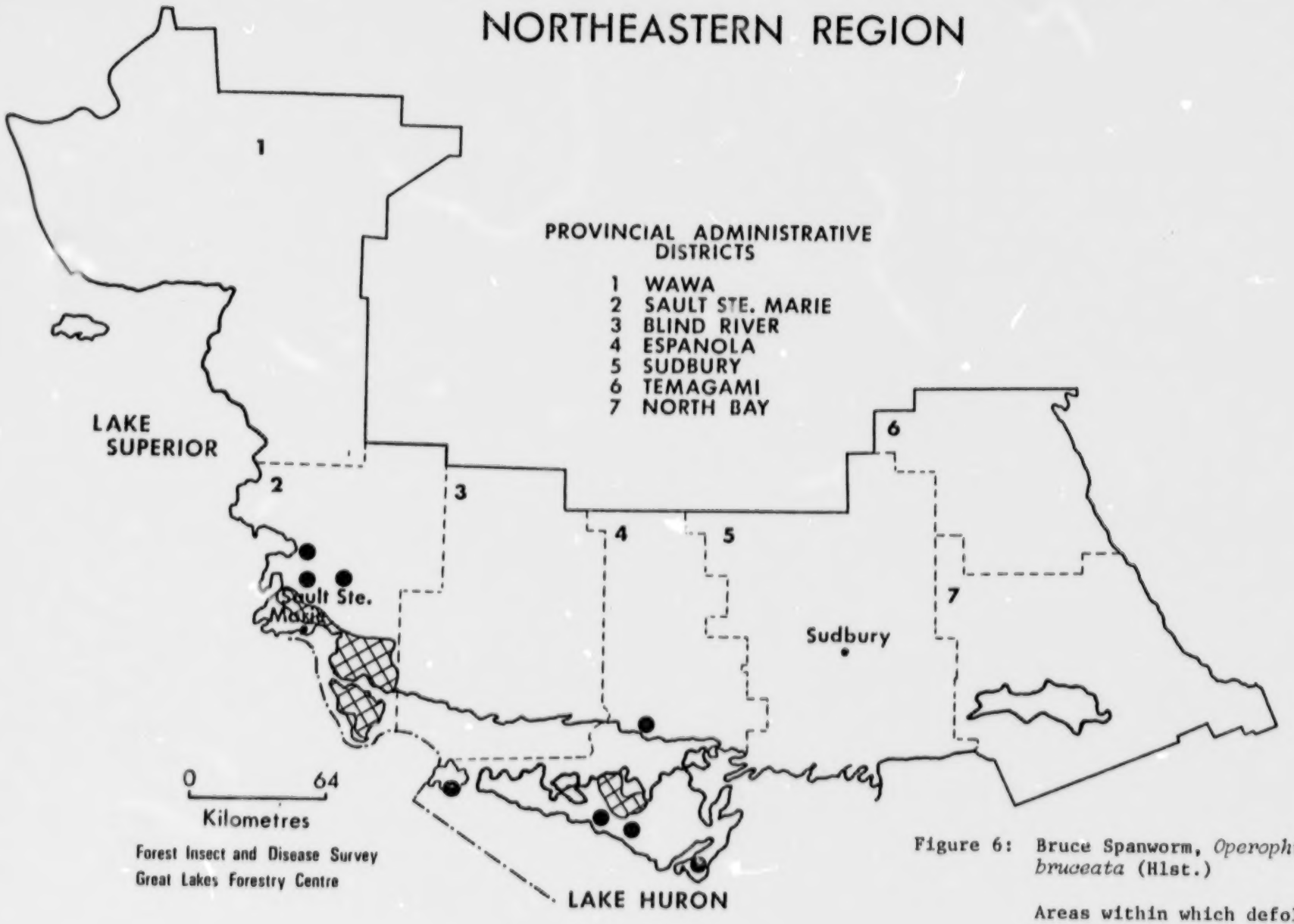

Figure 6: Bruce Spanworm, *Operophtera bruceata* (Hlst.)

Areas within which defoliation occurred in 1986

Moderate-to-severe.. ● or ⊠

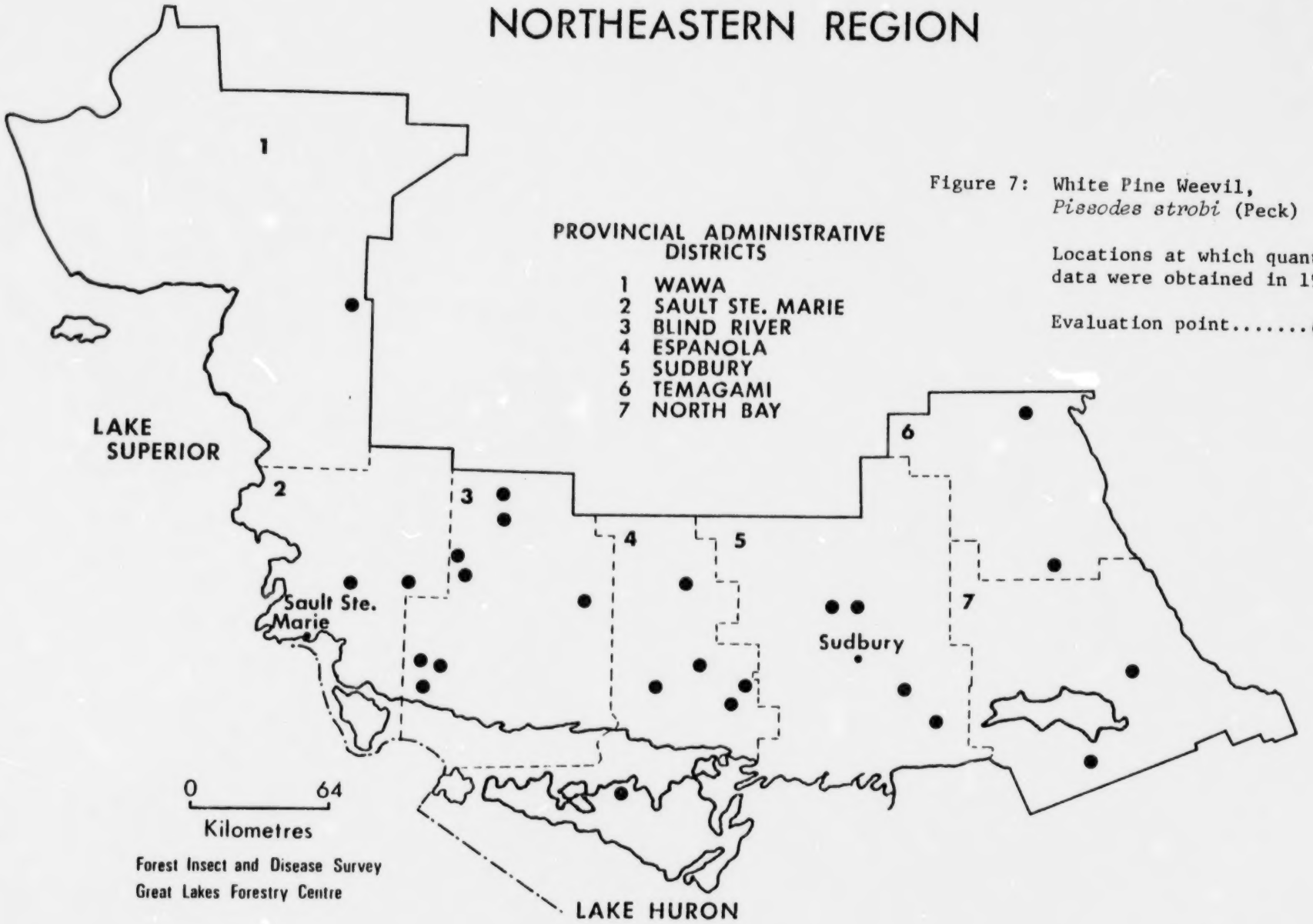

Figure 7: White Pine Weevil, *Pissodes strobi* (Peck)

Locations at which quantitative data were obtained in 1986

Evaluation point.....●

Table 8. Summary of damage by white pine weevil in plantations in the Northeastern Region from 1984 to 1986 (counts based on the examination of 150 randomly selected pine trees at each location).

Location (Twp)	Host(s)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Leaders attacked (%)		
					1984	1985	1986
Wawa District							
Recollet	jP	3	2,500	3.0	-	-	1
Sault Ste. Marie District							
Hurlburt	jP	50	5,000	2.0	4	3	5
Hodgins	jP	2	2,000	2.0	-	-	6
Blind River District							
Martel	jP	25	2,500	2.0	-	-	3
Villeneuve	jP	50	3,000	2.0	2	1	5
Lane	jP	10	3,000	2.0	-	4	7
Timbrell	jP	100	3,000	2.0	-	1	5
Wells	wP	2	2,000	2.0	-	-	6
Kirkwood	wP	10	2,500	4.0	-	-	13
Haughton	jP	10	1,000	2.0	3	2	6
Viel	jP	100	3,000	1.0	-	4	3
Espanola District							
Nairn	jP	24	5,000	3.0	6	2	2
Merritt	jP	10	3,000	2.0	-	5	6
Oshell	jP	50	3,000	2.1	-	-	2
Tennyson	ScP	10	2,500	2.5	-	-	14
Dunlop	jP	5	3,000	2.0	-	-	4
Allan	wP	2	1,750	1.5	-	-	2
Sudbury District							
Hendrie	jP	50	1,500	4.0	2	1	2
Lumsden	jP	20	4,500	1.8	20	2	2
Levack	jP	10	1,600	1.8	-	-	2
Cosby	wP	4	1,300	4.9	-	-	3
North Bay District							
Phelps	wP	5	300	0.9	-	-	6
Gurd	wP	4	900	6.7	-	-	1
Temagami District							
Milne	jP	50	5,000	2.0	-	-	3
Barr	jP	50	4,000	2.0	-	13	5

Larch Sawfly, *Pristiphora erichsonii* (Htg.)

Populations of this larch (*Larix* spp.) defoliator are apparently on the increase in the Northeastern Region. Records show that the sawfly was not observed in the region for three consecutive years prior to 1985 when a trace population was found in Winkler and Campbell townships in the Blind River and Espanola districts. In 1986, an increase in the number and distribution of sawfly colonies was recorded when scattered colonies causing light defoliation were recorded at one, two and three locations in the Sault Ste. Marie, Espanola and Blind River districts, respectively.

The sawfly is a serious pest of larch, periodically reaching epidemic numbers and causing nearly complete defoliation of individual trees or entire stands (see photo page). Repeated defoliation retards growth and weakens the affected trees, leaving them susceptible to attack by secondary insects such as bark beetles and wood borers.

Table 9. Other forest insects.

Insect	Host(s)	Remarks
Aceria sp. (nr. *dispar* [Nalepa]) Aspen leaf mite	tA	conspicuous foliar damage observed at widely scattered points, particularly in Temagami District
Acleris variana (Fern.) Eastern blackheaded budworm	wS	trace populations in Nadjiwon Twp, Wawa District
Acrobasis betulella Hlst. Birch tubemaker	wB	common in Sudbury and Temagami districts, with defoliation up to 60% on occasional trees
Acrobasis rubrifasciella Pack. Alder tubemaker	Al	moderate defoliation observed in a 2-ha stand in Laura Twp, Sudbury District
Altica ambiens alni Harr. Alder flea beetle	Al	small pockets of heavy damage were observed in the northern and central parts of Temagami District
Altica populi Brown Poplar flea beetle	bPo	Light defoliation in areas up to 100 ha in size occurred at scattered points in Espanola and Sudbury districts.

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Anacampsis innocuella Zell. Darkheaded aspen leafroller	Po	up to 20% defoliation observed in a 20-ha stand in Fairbanks Provincial Park, Sudbury District
Archips cerasivorana (Fitch) Uglynest caterpillar	Ch	Low populations were observed in the northern part of Temagami District and on Manitoulin Island, Espanola District.
Caloptilia alnivorella Cham. Alder leaf miner	Al	up to 85% defoliation observed in a 0.5-ha stand in Dowling Twp, Sudbury District
Caulocampus acericaulis MacG. Maple petiole borer	sM	light damage observed in a 5-ha stand in Fairbanks Provincial Park, Sudbury District
Chrysomela walshi Brown Balsam poplar leaf beetle	bPo	light damage apparent at scattered points in Olive and Strathcona twps, Temagami District
Coleophora comptoniella (McD.) [illegible] birch casebearer	wB, yB	Low populations occurred on scattered open-grown trees in Servos and McKim twps, Sudbury District.
Conophthorus resinosae Hopk. Red pine cone beetle	rP, wP	High numbers in pine stands over several years on islands and shorelines on Lake Temagami have resulted in pronounced thinning of the foliage.
Dasineura rachiphaga Tripp Spruce cone axis midge	rS	28% of cones damaged in a collection from Gurd Twp, North Bay District
Dryocampa rubicunda F. Green striped mapleworm	SM, rM	severe defoliation observed on roadside trees in Tennyson and Boon twps, Espanola District

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Epinotia solandriana L. Birch-aspen leafroller	wB, Po	light damage on small trees at widely scattered points in Sudbury, North Bay and Temagami districts
Erannis tiliaria (Harr.) Linden looper	deciduous	Moderate-to-severe defoliation occurred in a 12-ha stand in Sheguandah Twp, Espanola District. Light defoliation was recorded on roadside trees at scattered points in Sault Ste. Marie and Blind River districts.
Eupareophora parca (Cress.) Spiny ash sawfly	bAs	Up to 20% defoliation occurred in 2- to 3-ha stands in Olive, Strathcona and Askin twps, Temagami District, and in Sisk Twp, North Bay District.
Exoteleia dodecella L. Pine bud moth	ScP	Up to 40% bud mortality occurred in a 2-ha plantation in Dawson Twp, Espanola District.
Gonioctena americana (Schaef.) American aspen beetle	tA	heavy defoliation observed in a 0.5-ha area in Hallon Twp, Sudbury District
Hyphantria cunea (Dru.) Fall webworm	deciduous	Heavy defoliation of individual trees occurred in Commanda and Beaucage twps in North Bay District. Scattered colonies were also observed along roadsides in the above district and in Temagami and Sudbury districts.
Malacosoma americanum F. Eastern tent caterpillar	cherry	scattered colonies at widely separated points in Blind River and North Bay districts

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Malacosoma californicum pluviale Dyar Northern tent caterpillar	cherry	tents observed at scatterd locations in Alanen and Dahl twps, Wawa District
Neodiprion abietis complex Balsam fir sawfly	bS, wS, bS	light damage on upper crowns of scattered trees in Mattawan and Papineau twps, North Bay District
Neodiprion lecontei (Fitch.) Redheaded pine sawfly	rP	Low populations were observed in a 1-ha and a 50-ha plantation in Kirkwood and Parkinson twps, respectively, in Blind River District. Various degrees of damage occurred in plantations up to 50 ha in size in Phelps and Gurd twps, North Bay District.
Neodiprion nanulus nanulus Schedl. Red pine sawfly	rP, jP	Up to 40% defoliation was recorded through approximately 500 ha of forests along the shoreline of Lake Temagami. Small numbers of colonies were observed in Cox Twp, Sudbury District.
Neodiprion pratti banksianae Roh. Jack pine sawfly	jP	light defoliation evident in a 2-ha plantation in Foster Twp, Espanola District
Neodiprion sertifer (Geoff.) European pine sawfly	ScP	Light-to-moderate damage occurred in a 0.5-ha stand in Gordon Twp; scattered colonies were found in Billings and Allan twps, Espanola District, and in Fisher Twp, Sault Ste. Marie District.
Neodiprion swainei Midd. Swaine jack pine sawfly	jP	Light defoliation occurred on island 127 in Lake Temagami, Temagami District and at one point on the shore of Lake Nipissing in North Bay District.

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Neodiprion virginianus complex Redheaded jack pine sawfly	jP	small numbers on regeneration in a reclaimed gravel pit in Poulin Twp, Blind River District
Nymphalis antiopa (L.) Spiny elm caterpillar	deciduous	heavy damage on scattered clumps of trees along roadsides in Drury and Gurd twps in Sudbury and North Bay districts, respectively
Phyllonorycter ontario (Free.) Aspen leafblotch miner	tA	Small pockets of damage were observed at widely scattered points in the northern parts of Sudbury and North Bay districts and in Temagami District.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS, bS	Approximately 200 spruce trees were damaged in Finlayson Provincial Park, Temgami District; defoliation ranged up to 90% in the area. Light defoliation occurred on occasional roadside trees at scattered points elsewhere in the region.
Podapion gallicola Riley Pine gall weevil	rP	Trace mortality attributed to damage caused by this insect was observed at one point in Nipissing Twp, North Bay District.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	aMo	Various degrees of defoliation were observed on roadside trees at widely scattered points in Wawa, Sault Ste. Marie and Espanola districts.
Schizura concinna (J.E. Smith) Redhumped caterpillar	deciduous	heavy damage on 0.5 ha of willow trees along a roadside in Salter Twp, Espanola District

(cont'd)

Table 9. Other forest insects (concl.).

Insect	Host(s)	Remarks
Toumeyella parvicornis (Ckll.) Pine tortoise scale	scP, jP	high populations in a 0.5-ha Scots pine stand in Billings Twp, Espanola District
Zelleria haimbachi Busck Pine needle sheathminer	jP	low populations observed at scattered points in the northern portion of Temagami District

A colony of larch sawfly, *Pristiphora erichsonii* (Htg.) on a tamarack twig (*Larix laricina* [Du Roi] K. Koch.

Severe defoliation of a tamarack stand by larch sawfly

Scleroderris canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard, caused stem canker (above) and tree mortality (below) in a young red pine (*Pinus banksiana* Lamb.) stand.

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria mellea* (Vahl: Fr.) Kummer

Armillaria root rot will attack and kill many species of trees, particularly, trees weakened by other factors such as detrimental weather conditions or poor growing sites. Over the past several years, mortality caused by the pathogen has been observed at moderate levels in many plantations and regenerated areas in the region.

Surveys in 1986 showed no significant change in the incidence of damage caused by the disease. Evaluations conducted in nine pine plantations at widely separated locations showed that current mortality ranged from 0.6% to 3.0% and averaged 1.0% (Table 10 and Fig. 8).

Table 10. Current mortality caused by Armillaria root rot in nine plantations in the Northwestern Region in 1986 (counts based on the examination of 150 randomly selected pine trees at each location).

Location (Twp)	Host(s)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Current mortality (%)
Wawa District					
Michano	JP	15	2,500	1.2	0.6
Blind River District					
Viel	JP	100	3,000	1.0	0.6
Espanola District					
Nairn	rP	10	1,900	2.0	1.3
Durban	JP	100	4,000	2.0	3.0
Oshell	JP	100	3,700	2.2	0.6
Tennyson	rP	40	3,900	0.5	0.6
Sudbury District					
Street	rP	20	3,600	2.0	0.6
North Bay District					
Sisk	rP	10	1,800	5.0	0.6
Calvin	rP	2	1,900	2.0	1.3

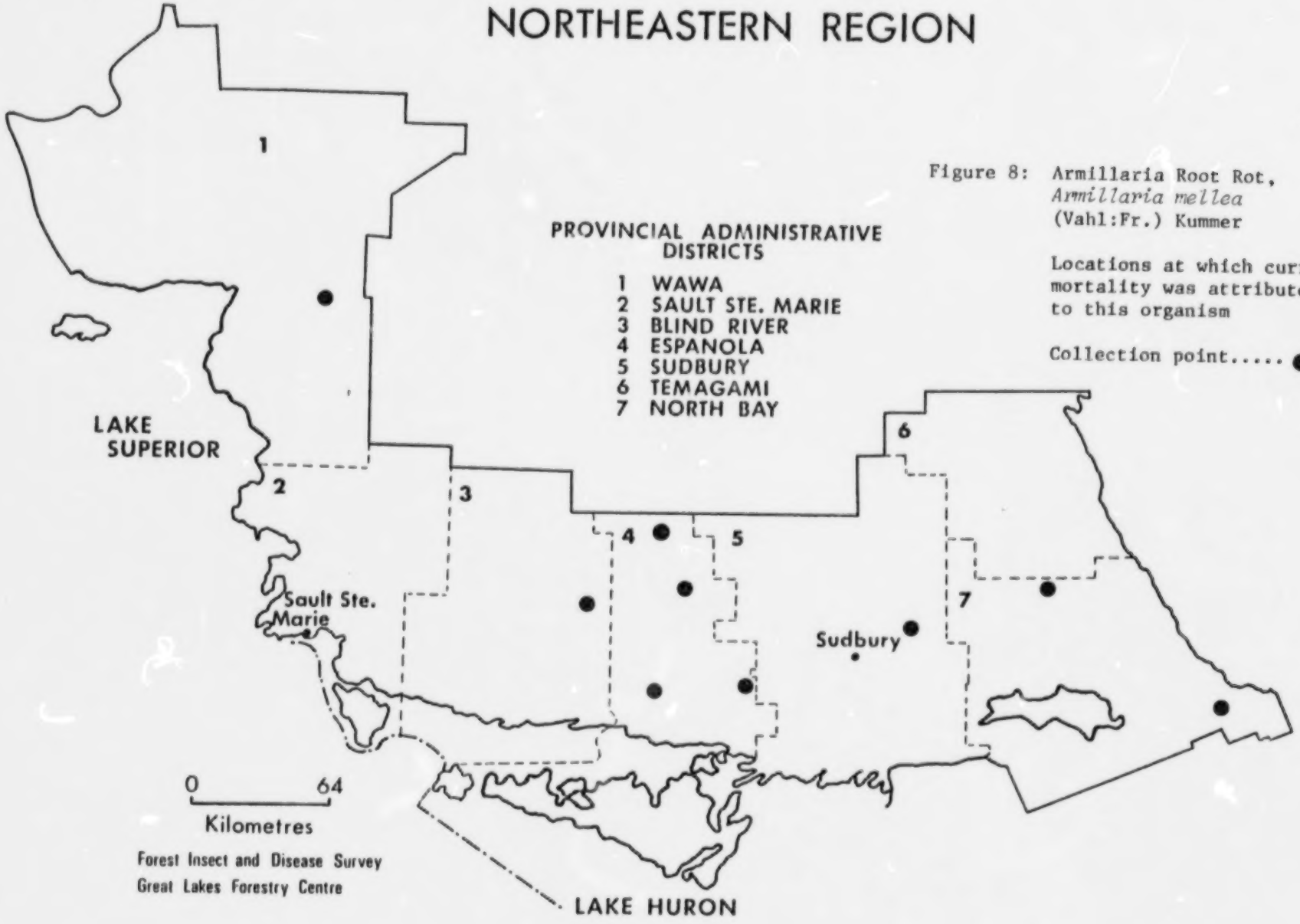

Figure 8: Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer

Locations at which current mortality was attributed to this organism

Collection point..... ●

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

An increase in the area affected by the North American race of this pathogen, the cause of a serious disease of pine plantations and regeneration, was recorded for the third consecutive year in the Northeastern Regior in 1986 (Fig. 9).

New infection centers were recorded in Bullock Township in the Wawa District and in Timbrell and Parkinson townships in the Blind River District.

Evaluations conducted in affected plantations at nine locations revealed that the incidence of infection and current mortality ranged from 0.6% to 42% and 0.0% to 5.3%, respectively (Table 11). However, in the newly recorded infection centers in the abovementioned townships, the incidence of infection was less than 5% and no current mortality could be found.

Table 11. Summary of damage caused by Scleroderris canker in the Northeastern Region in 1986 (counts based on the examination of 150 randomly selected pine trees at each location).

Location (Twp)	Host(s)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Trees affected (%)	Tree mortality (%)
Wawa District						
Bullock	jP	110	3,000	0.5	4.0	0.0
Sault Ste. Marie District						
Gaudette	jP	25	3,000	1.5	18.0	4.0
Hurlburt	jP	50	3,000	2.0	0.6	0.6
Blind River District						
Galbraith	rP	5	3,000	2.5	3.0	0.0
Haughton	jP	10	2,000	1.5	42.0	5.3
Kirkwood	rP	1	3,000	1.0	20.0	0.6
Timbrell	rP	10	3,000	1.0	3.0	0.0
North Bay District						
Phelps	rP	50	2,500	3.0	31.3	2.7
French	rP	2	2,500	3.0	1.3	0.0

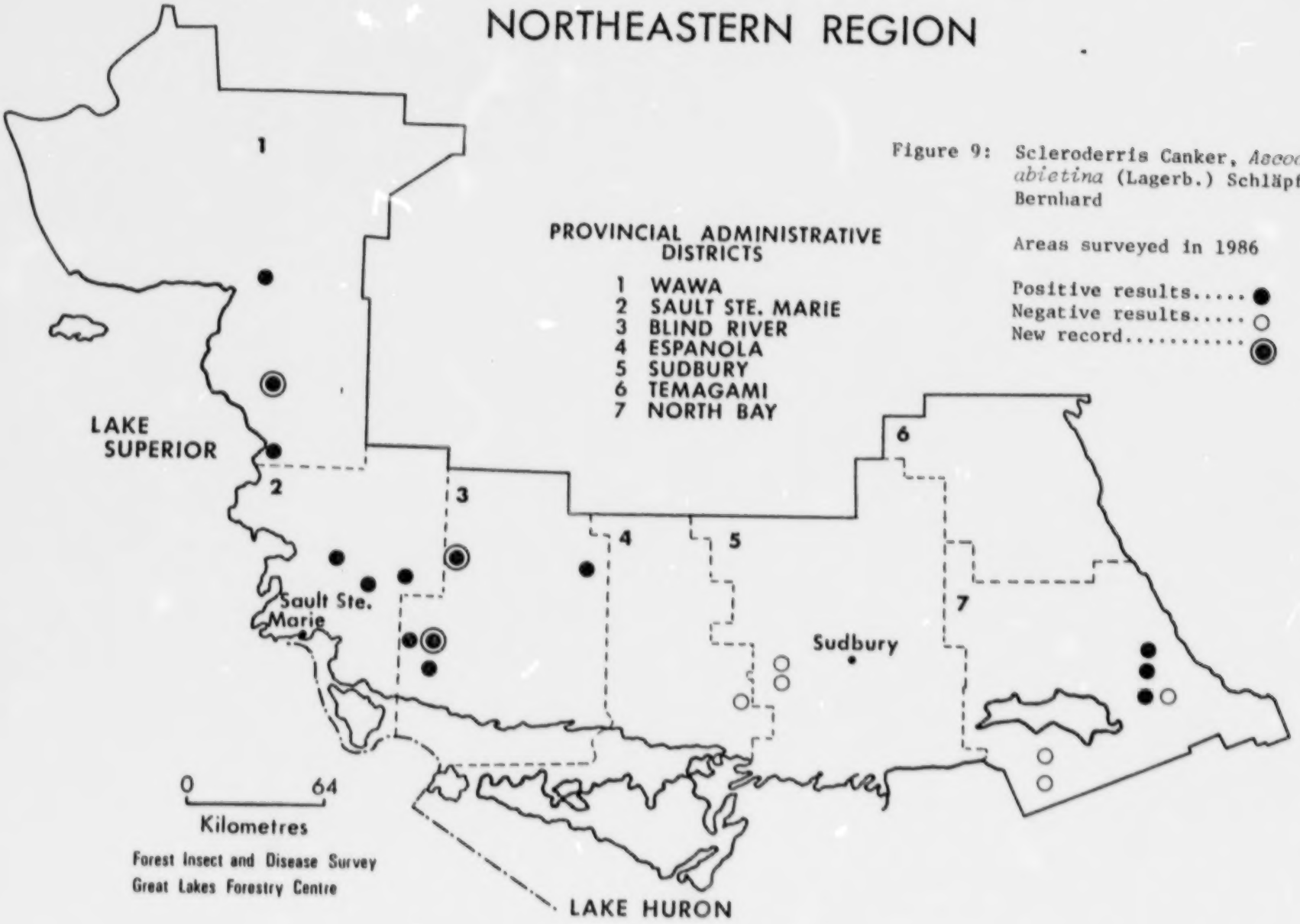

Figure 9: Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Over the past several years, serological tests of disease samples taken in previously and currently recorded infection centers have been carried out at the Great Lakes Forestry Centre (GLFC) to determine if the European race of the pathogen is present in the areas. Although this race is known to occur at several locations in southern Ontario it has not been recorded in the Northeastern Region.

Infection by the pathogen occurs through the buds, needles or expanding shoots. Symptoms on pine are the death of the leader or lateral branches, followed by cankering or girdling of the main stem and eventual mortality (see photo page). Although stem cankering commonly occurs on affected trees, it is often absent from very young, recently planted trees when mortality occurs.

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

Surveys in jack pine stands show that, as in the previous three years, an increase in the incidence of infection and distribution of this gall-forming pathogen occurred in the Northeastern Region in 1986.

Disease evaluations were conducted in six jack pine stands where the disease was observed. Levels of infection in young plantations ranged from 0.6% in Viel Township to 31.0% in Lane Township in the Blind River District (Table 12).

Table 12. Summary of damage by the western gall rust in the Northeastern Region in 1986 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host(s)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Trees affected (%)	Trees[a] severely affected (%)
Blind River District						
Lane	jP	25	2,500	0.5	31.0	23.0
Haughton	jP	10	1,000	1.5	6.0	0.0
Viel	jP	50	3,000	0.5	0.6	0.0
Espanola District						
Tennyson	scP	2,500	10	2.5	2.0	2.0
Oshell	jP	2,600	50	2.1	18.0	3.0
Sudbury District						
Rathburn	jP	4,000	8	4.0	3.0	3.0

[a] stem galls

This pathogen is capable of causing serious branch mortality on trees in all age classes and whole-tree mortality in stands of young jack pine in plantations and regenerated areas where branches or stems are infected and become girdled by the fungus. In young stands, stems are often girdled; therefore, mortality occurs to the part of the stem and branches distal to the infected area.

Serious damage is likely to occur in the Lane Township plantation, where 2.3% of the trees examined were affected by up to six stem galls.

Shoot Blight, *Venturia macularis* (Fr.) E. Müller & v. Arx

In 1986, surveys revealed that damage caused by this shoot blight in aspen regeneration stands was generally low in the Northeastern Region.

Evaluations at five points in pure stands showed significant decreases from the previous year in the number of trees infected and the incidence of leader mortality (Table 13). Leader mortality averaged 4.8% in 1986 in comparison with 26.6% in 1985. Leader mortality caused deformed trees and in some instances whole-tree mortality occurred after repeated attacks. Light infection was also observed on roadside and fringe aspen regeneration at numerous locations.

Table 13. Summary of damage by shoot blight in regeneration in the Northeastern Region from 1984 to 1986 (counts based on the examination of 150 randomly selected trembling aspen trees at each location).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Trees affected (%)			Leader mortality (%)		
				1984	1985	1986	1984	1985	1986
Wawa District									
Dunphy	10	4,000	1.4	32.6	50.6	4.6	20.6	30.0	2.6
Blind River District		-							
Villeneuve	25	5,000	2.3	5.3	44.6	21.3	0.7	23.3	4.6
Viel	5	1,000	2.0	-	-	11.0	-	-	3.0
Espanola District									
Durban	30	8,000	2.8	-	-	12.0	-	-	5.0
Sudbury District									
Levack	10	9,000	2.5	-	-	29.0	-	-	9.0

Table 14. Other forest diseases.

Disease	Host(s)	Remarks
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	High incidence levels but low damage levels were recorded sporadically in Espanola, Sudbury and Temagami districts. Smaller patches of heavy defoliation up to 1 ha in size were observed frequently in the abovementioned districts during aerial mapping for budworm defoliation on spruce and pine.
Coleosporium asterum (Dietel) Sydow Pine needle rust	jP, rP	Heavy damage was recorded in a 10-ha plantation of 1.5-m jack pine in Alanen Twp, Wawa District. Low levels of infection were recorded occasionally in the remainder of the region.
Cronartium ribicola J.C. Fischer White pine blister rust	wP	An incidence level of 33% and current mortality of 6% were recorded in Arlie Twp, Wawa District. Plantations sampled in Wells Twp, Blind River District and Foster Twp, Espanola District had 6% of the trees affected and a mortality rate of 2% at the Wells Twp location.
Discula campestris (Pass.) v. Arx Anthracnose	rM, sM	Symptoms of this pathogen were observed at numerous points on roadside maple regeneration, particularly in the southern portion of the Sault Ste. Marie and Blind River districts. Low damage levels were also recorded in the acid rain plot in Wishart Twp, Sault Ste. Marie District.

(cont'd)

Table 14. Other forest diseases (concl.).

Disease	Host(s)	Remarks
Inonotus tomentosus (Fr.) Gilbertson Tomentosus root rot	wS	This destructive pathogen was responsible for mortality to a 21-m tree and four adjacent smaller trees in North Himsworth Twp, North Bay District
Leucostroma kunzei (Fr.) Munk Cytospora canker	wS	Understory spruce in the acid rain plot in Calvin Twp, North Bay District exhibited cankering on 20% of the lower branches.
Lophodermium sp. Needle cast	rP, jP bS	Foliar damage ranged from 5% to 25% on 58% of the trees in a 40-ha red pine plantation in Gurd Twp, North Bay District. Lighter damage was recorded on red pine in Tennyson Twp, jack pine in Rathburn Twp (both in the Sudbury District) and black spruce in Commanda Twp, North Bay District.
Sirococcus conigenus (DC.) P. Cannon & Minter Shoot blight	rP	Light infection levels were recorded near the gatehouse at Agawa Bay Provincial Park, Wawa District.
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton Tip blight	rP	A high incidence of light damage was recorded over a 10-ha plantation 10-15 m high in Gurd Twp, North Bay District and a 20-ha plantation of 10-m trees in Servos Twp, Sudbury District.

ABIOTIC DAMAGE

Frost

Current shoot mortality caused by late spring frosts was evident at numerous points in the region. The most serious damage occurred to balsam fir *(Abies balsamea* [L.] Mill.) and white spruce *(Picea glauca* [Moench] Voss) growing on exposed fringes of stands and in plantations. Light damage was also recorded on white pine *(Pinus strobus* L.) at one location. Damage evaluations in a 20-ha white spruce plantation in Rose Township in the Blind River District and in a 5-ha white pine plantation in Phelps Township in the North Bay District revealed damage on 100% and 40% of the trees, respectively. Current shoot mortality ranged from approximately 50% to more than 90% in the white spruce plantation and from 2% to 5% in the white pine plantations.

Frost damage to current shoots very often kills the leader, thereby retarding the height growth of affected trees.

Needle Droop

A high incidence of needle droop, seemingly caused by drying winds combined with high temperature and low humidity, was recorded in red pine *(Pinus resinosa* Ait.) plantations in Villeneuve and Parkinson townships in the Blind River District in 1986.

Evaluations carried out in a 2-ha plantation in Villeneuve Township and in a 10-ha plantation in Parkinson Township revealed that damage was present on 82% and 32% of the trees, respectively. Although the previous year's foliage was most seriously damaged, current bud mortality was observed on many of the affected trees. This type of damage deforms the trees and retards tree growth.

Other Abiotic Damage

Heavy salt damage was evident on white pine trees at scattered points along Highway 17 from North Bay to the Mattawa area and on 3-m red pine and jack pine roadside trees along a 0.5-km section of Highway 11 south of Powassan in the North Bay District. The previous year's foliage on affected trees sustained as much as 50% mortality in these areas.

Up to 30% foliar damage caused by winter drying was evident on small numbers of red pine trees in the Nairn Centre area and in a 20-ha plantation in Tennyson Township in the Espanola District. In the Bonfield area, North Bay District, scattered, open-grown white pine regeneration was damaged; occasional trees had up to 60% of their foliage killed.

SPECIAL SURVEYS

Gypsy Moth Survey

An annual survey to detect and monitor populations of the gypsy moth, *Lymantria dispar* L., is carried out each year throughout the province. As in several previous years, pheromone traps were deployed in provincial parks and campsites as well as in a number of privately owned trailer parks and campsites in the Northeastern Region (Fig. 10).

These pheromone traps, containing a sex attractant and a sticky substance, lure male moths in the vicinity to the trap where, upon entering, they are immobilized by the sticky substance. Moth captures in these traps should not be misconstrued to indicate the presence of an established gypsy moth population in an area. They do, however, indicate the possibility of an infestation and, therefore, the need for intensive surveys in the spring of the following year to determine if other stages of the pest are present.

In 1986, a total of 80 traps were deployed at 20 locations in the region, two traps at each of 15 points and 10 traps in five areas where positive captures of moth had been recorded in 1985. Examination of the traps in late summer revealed that negative results were obtained at nine of the sites and positive catches were recorded at the remainder. Catches ranged from a single moth at each of three locations to an average of 13 per trap in Restoule Provincial Park in the North Bay District (Table 15).

Surveys to determine if residual populations were present in area where moths have been captured have proved negative to date. These surveys will be repeated in the spring of 1987.

White Pine Plantation Survey

Special surveys have been conducted in plantations and high-value stands of various tree species over the past several years to determine the status of insect and disease pests therein. In 1986, as well as in 1983, white pine was chosen for this survey throughout the southern part of the province, and in the Northeastern Region. Ten areas were selected in the region in three height classes: <2 m, 2-6 m and >6 m (Fig. 11). Each stand was surveyed twice by means of a stand sampling procedure: from 1 to 15 June and from 14 July to 15 August. The insects and diseases selected for the survey are listed below:

Insects: white pine weevil, eastern pine shoot borer, pine spittlebug, *Aphrophora cribrata* (Wlk.), and pine bark adelgid, *Pinus strobi* (Htg.).

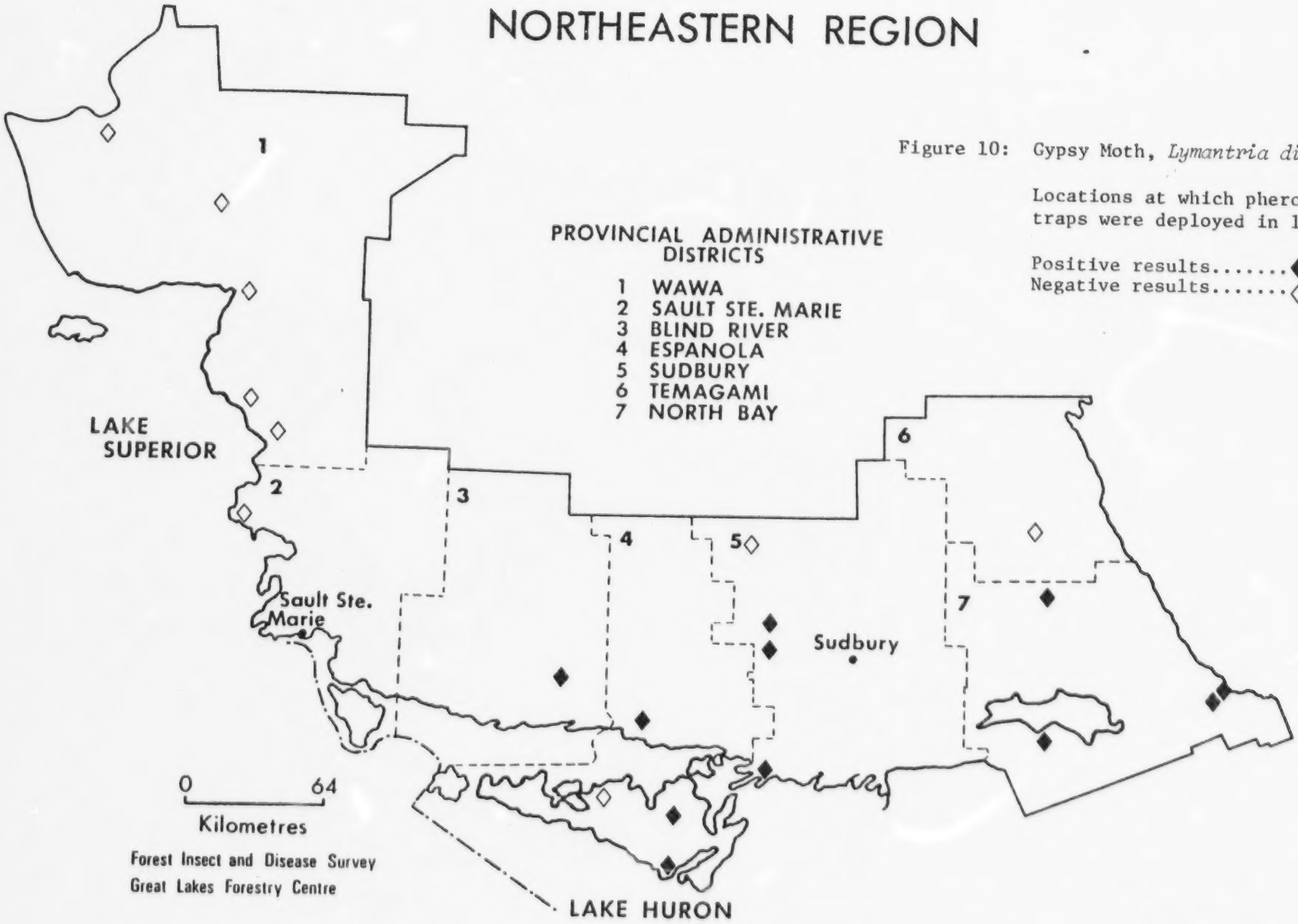

Figure 10: Gypsy Moth, *Lymantria dispar* (L.)

Locations at which pheromone traps were deployed in 1986

Positive results.....◆
Negative results.....◇

Table 15. Gypsy moth pheromone trap locations, number of captures, and years in which male moths were captured in the Northeastern Region (two traps deployed at each location except where otherwise indicated).

Location	No. of male moths captured	Year(s) in which captures were made
Wawa District		
White Lake Provincial Park	1	1982
Obatanga Provincial Park	1	1981
Rabbit Blanket Lake Campground	1	1980
Agawa Bay Campground[a]	1	1985
Crescent Lake Campground	-	-
Sault Ste. Marie District		
Pancake Bay Provincial Park	-	-
Blind River District		
Mississauga Provincial Park[a]	2,1	1985, 1986
Espanola District		
Chutes Provincial Park	3	1986
Gore Bay, Gordons Lodge	-	-
Bidwell, Red Lodge[a]	1, 32	1984, 1985, 1986
South Baymouth Trailer Park[a]	1, 25	1985, 1986
Sudbury District		
Halfway Lake Provincial Park	-	-
Windy Lake Provincial Park	1, 1	1981, 1986
Fairbanks Provincial Park	1, 7	1984, 1986
Killarny Provincial Park	16	1986
North Bay District		
Antoine Provincial Park	1, 51	1985, 1986
Martin River Provincial Park	1	1986
Restoule Provincial Park	27	1986
Samuel de Champlain Provincial Park	1, 22	1983, 1986
Temagami District		
Finlayson Point Provincial Park	-	-

[a] 10 traps deployed at these locations

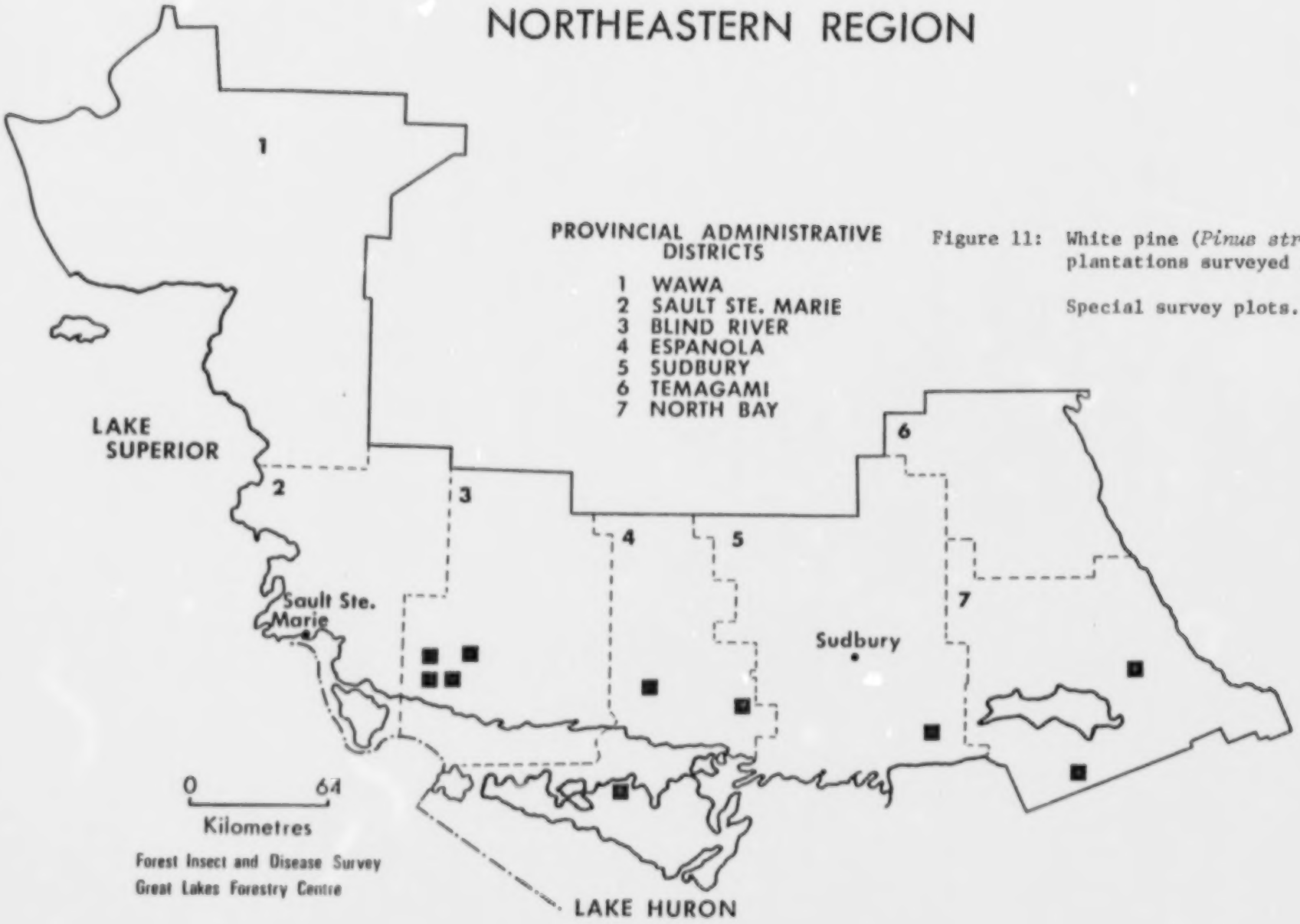

Figure 11: White pine (*Pinus strobus* L.) plantations surveyed in 1986

Special survey plots.....■

Diseases: Armillaria root rot, white pine blister rust, basal stem cankers and foliar diseases.

All of the insect species selected for the survey, except the eastern pine shoot borer, were found in one or more of the sample areas (Table 16).

Table 16. Summary of the incidence of insect-caused damage noted in a survey conducted in white pine plantations in the Northeastern Region in 1986 (counts based on the examination of 150 randomly selected trees at each location).

Location Twp	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	White pine weevil	Pine bark adelgid	Pine spittlebug
				Leaders attacked (%)	Trees infested (%)	Trees infested (%)
Blind River District						
Kirkwood	10	2,500	3.9	12.6	32.0	1.3
Kirkwood	25	2,500	11.4	0.0	34.6	0.0
Kirkwood	10	1,200	17.1	0.0	4.6	0.0
Wells	2	2,000	2.5	6.0	0.0	22.6
Espanola District						
Allan	2	1,600	1.4	1.3	11.3	16.0
Tennyson	60	670	4.4	7.3	4.0	0.0
Foster	10	1,500	5.2	2.6	0.0	7.3
Gurd	4	550	6.7	0.0	6.0	6.6
Sudbury District						
Cosby	15	3,000	5.0	2.6	0.0	4.0
North Bay District						
Phelps	5	280	0.9	5.3	26.6	14.6

No Armillaria root rot or foliar diseases were found. Positive results of other disease pathogens recorded in one or more of the sample areas are presented in Table 17.

Table 17. Summary of the incidence of insect-caused damage noted in a survey conducted in white pine plantations in the Northeastern Region in 1986 (counts based on the examination of 150 randomly selected trees at each location).

Location Twp	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	White pine blister rust: Leaders attacked (%)	Basal stem cankers: Trees affected (%)
Blind River District					
Kirkwood	10	2,500	3.9	1.3	0.6
Kirkwood	25	2,500	11.4	0.6	0.6
Kirkwood	10	1,200	17.1	0.0	0.0
Wells	2	2,000	2.5	6.6	3.3
Espanola District					
Allan	2	1,600	1.4	0.0	0.0
Tennyson	60	670	4.4	0.0	0.0
Foster	10	1,500	5.2	6.0	1.3
Gurd	4	550	6.7	0.0	0.0
Sudbury District					
Cosby	15	3,000	5.0	1.3	0.0
North Bay District					
Phelps	5	280	0.9	0.0	0.0

Populations of the white pine weevil were present in seven of the 10 stands sampled. The incidence of leader attack averaged 5.3% in affected stands.

Light infestations of the pine spittlebug were recorded in six of the sample areas. Although little damage was discernible in lightly infested stands, high populations can cause serious twig and branch mortality where the insects feed.

The pine bark adelgid was present at a trace level in seven of the stands examined. Although low numbers are of little consequence, high populations are capable of causing serious damage to small-diameter trees and nursery stock.

Damage by white pine blister rust was found in four of the plantations sampled. The incidence averaged 3.6% in affected stands.

White Pine Cone and Seed Survey

A survey of insects and diseases damaging white pine cones was conducted across southern Ontario and in the Northeastern Region in 1986. Cone collections were made in plantations in Kirkwood Township, Blind River District and in the Gurd Township Seed Production area, North Bay District.

One hundred second-year cones in the green succulent stage were collected in the first week of July at each of the above locations.

Examination of the cones at the Great Lakes Forestry Centre (GLFC) revealed that 9.0% were damaged in the Kirkwood Township sample, and there was an average seed loss of 14.3%. In the Gurd Township sample 35.0% of the cones were damaged, and there was an average seed loss of 17.6% (Table 18). The largest portion of seed loss was caused by insects, i.e., *Resseliella* species, white pine coneworm, *Eucosma tocullionana* Heinr. and Lepidopterous species, and the next largest portion by an unknown agent. No damage caused by disease pathogens was found.

Table 18. Summary of the incidence of insect damage and seed loss in white pine cones in the Northeastern Region in 1986 (counts based on the examination of 100 randomly selected cones at each location).

Location Twp	Avg no. of seeds per sound cone	Cones damaged (%)	Avg seed loss in damaged cones (%)	Cones affected by insects			
				Resseliella species	Lepidoptera species (%)	White pine coneworm (%)	Unknown (%)
Blind River District							
Kirkwood	42	9	14.3	1.0	0.0	0.0	8.0
North Bay District							
Gurd	51	35	17.6	25.8	1.2	7.0	0.0

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Over the past several years, surveys have been conducted to determine the presence and distribution of this pest of pines in the Northeastern Region.

In 1986, samples were obtained from suspect trees at 29 locations and forwarded to GLFC for analysis (Fig. 12). The analysis revealed that 20 of the samples contained nematodes. More than one species of nematode was observed in the group of samples, which were submitted to the Biosystematics Research Institute in Ottawa for further analysis and nematode identification. The results of this study are incomplete at this date.

The results of a similar study of 37 infested samples collected in the summer and submitted to the Biosystematics Research Institute in the fall of 1985 were obtained in the spring of 1986. The study revealed that the abovementioned nematode was present in nine of these samples obtained at scattered points in the Blind River, Sudbury and North Bay districts (Fig. 13).

The host species affected were white pine, red pine, jack pine, Scots pine and balsam fir in the Blind River District, and jack pine in the Sudbury and North Bay districts.

The nematode can be introduced to healthy and distressed trees in early summer by adult sawyer beetles, *Monochamus* spp., feeding on twigs and branches or ovipositing after migrating from previously infested trees. Bark beetles are also capable of spreading the nematode when migrating from infested trees to damaged parts of trees such as broken branches caused by high winds, hail or snow. When a tree becomes infested by the nematode, the population increases rapidly, disrupting the sap flow and thereby causing wilted foliage and very often tree mortality by the fall of the same year.

Acid Rain National Early Warning System (ARNEWS)

As part of a national early warning system to detect and monitor the effects of acid rain on the forest over extended periods, four study plots were established in the Northeastern Region in 1984 and 1985. Each plot was installed on land reserved for this purpose. Three of the plots were established in mixed hardwood stands in Wishart, Hyman and Calvin townships in the Sault Ste. Marie, Sudbury and North Bay districts, respectively, and the fourth in a pure jack pine stand in Huotari Township in the Wawa District.

Each plot is monitored at specific intervals in the spring, summer and fall of each year to determine the incidence of damage caused by acid rain, insect populations or diseases, and any detectable change in stand structure.

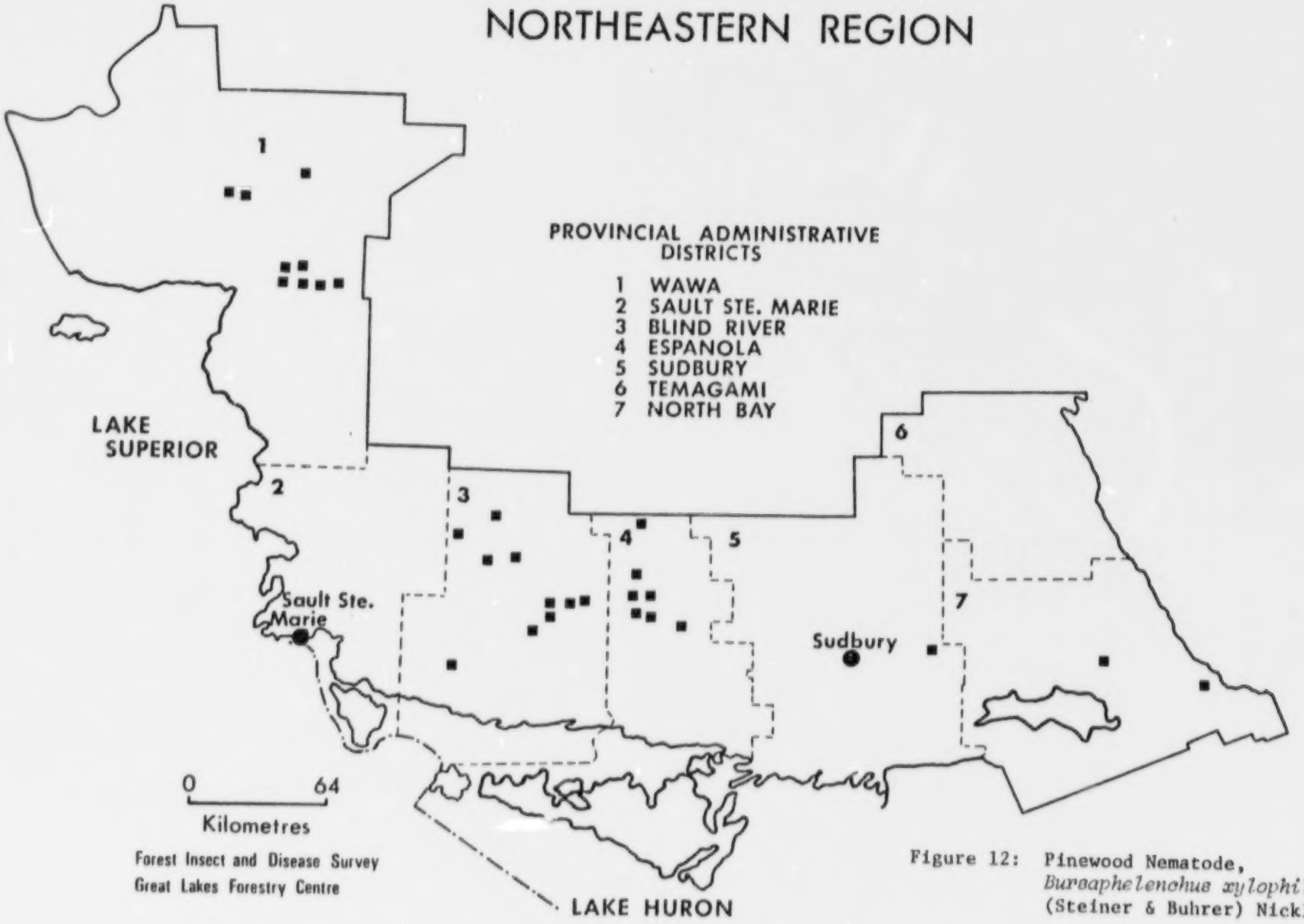

Figure 12: Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Locations at which samples were taken in 1986..... ■

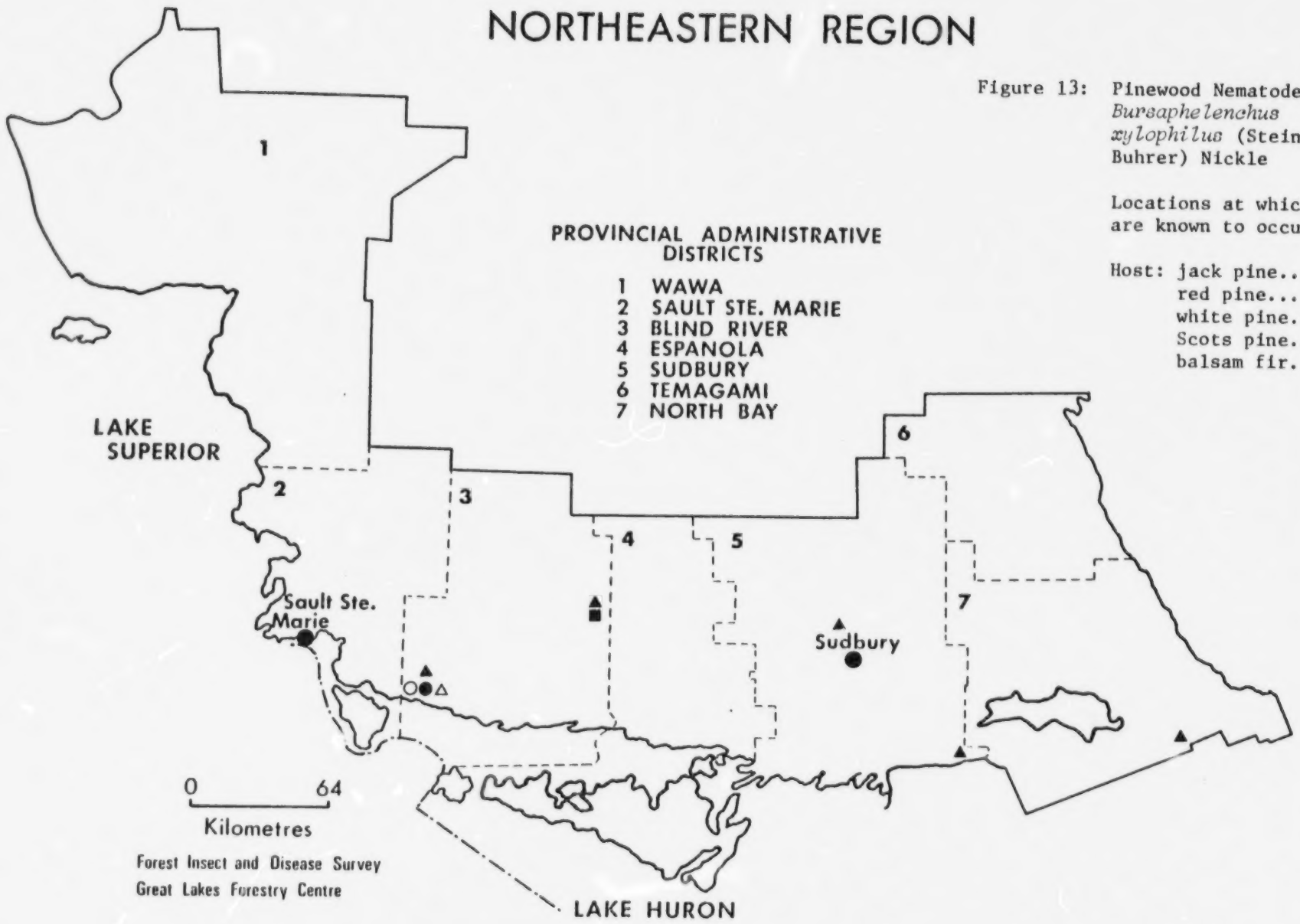

Figure 13: Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Locations at which nematode are known to occur

Host: jack pine.....▲
red pine.....△
white pine.....●
Scots pine.....○
balsam fir.....■

In 1986, monitoring revealed no damage caused by acid precipitation or changes in stand structure. The insect and disease surveys conducted in each plot revealed a trace of defoliation caused by forest tent caterpillar feeding in the Hyman and Calvin township plots. The incidence of diseases was negative in each plot; however, abiotic damage was found in the Wishart Township plot, where light leaf scorch was recorded for the second consecutive year on small sugar maple regeneration.

Climatic Data

Weather can cause variation in the development of tree growth, insect populations and disease pathogens. Certain weather conditions can create a favorable atmosphere in forests or predispose them to damage and cause major fluctuations in insect populations and disease incidence. Abnormal weather conditions cause abiotic damage such as frost, wilting or scorch of foliage, breakage and blowdown due to wind, branch and stem breakage because of snow or hail overloads, and drought. Weather data for three locations in the region are presented in Table 19. This table includes the monthly mean temperature, total precipitation and 1986 deviation from the norm established over a 30-year period.

Table 19. Summary of mean temperature, total precipitation and deviation from the norm for the year 1986 for three locations across the Northeastern Region.

Location	Month	Mean temperature (°C)		Deviation from norm (°C)	Total precipitation (mm)		Deviation from norm (%)
		Normal	Actual		Normal	Actual	
Sault Ste. Marie							
Airport	January	-10.1	-11.2	-1.1	74.0	40.5	-45.3
	February	-10.0	-10.3	-0.3	68.0	22.7	-66.6
	March	-5.1	-3.8	+1.3	60.4	99.5	+64.7
	April	3.1	5.9	2.8	64.4	36.1	-43.9
	May	9.1	11.3	2.2	84.2	33.4	-60.3
	June	14.6	12.8	-1.8	74.2	142.2	+91.6
	July	17.3	18.0	+0.7	55.6	99.9	+79.6
	August	16.9	17.5	+0.6	82.7	102.8	+24.3
	September	12.8	12.3	-0.5	95.3	128.2	+34.5
	October	7.6	6.5	-1.1	74.2	85.6	+15.4
	November	0.7	-1.0	-1.7	93.3	70.9	-24.0
	December	-6.7	-3.2	+3.5	79.6	53.5	-32.8
Sudbury							
Airport	January	-13.7	-13.8	-0.1	57.5	29.4	-48.9
	February	-12.5	-11.6	+0.9	47.0	16.2	-65.5
	March	-6.0	-4.5	+1.5	55.2	102.7	+86.1
	April	2.7	6.3	+3.6	61.1	26.3	-57.0
	May	10.5	12.9	+2.4	67.1	76.4	+13.9
	June	16.0	14.0	-2.0	82.8	93.0	+12.3
	July	18.7	18.6	-0.1	83.1	85.8	+3.2
	August	17.3	16.5	-0.8	82.9	51.5	-37.9
	September	12.2	11.3	-0.9	106.5	90.8	-14.7
	October	6.3	5.2	-1.1	74.6	76.5	+2.5
	November	-1.2	-3.0	-1.8	77.8	42.6	-45.2
	December	-10.2	-6.4	-3.8	65.0	61.1	-6.0
North Bay							
Airport	January	-13.0	-13.6	-0.6	63.5	40.0	-37.0
	February	-11.3	-11.6	-0.3	56.2	23.2	-58.7
	March	-5.3	-4.4	+0.9	61.1	103.3	+69.1
	April	3.2	6.2	+3.0	62.3	59.2	-5.0
	May	10.6	12.2	+1.6	69.3	125.4	+80.9
	June	15.7	13.4	-2.3	85.1	117.2	+37.7
	July	18.3	17.8	-0.5	102.4	171.4	+67.4
	August	17.0	16.0	-1.0	98.7	61.0	-38.2
	September	12.2	11.3	-0.9	115.9	103.4	-10.8
	October	6.4	5.0	-1.4	87.7	86.5	-1.4
	November	-1.0	-3.3	-2.3	86.6	54.2	-37.4
	December	-9.7	-7.0	+2.7	75.4	65.3	-13.4